TO 31R2-2GRC238-1

OPERATION AND MAINTENANCE INSTRUCTIONS WITH ILLUSTRATED PARTS BREAKDOWN

ORGANIZATIONAL LEVEL

RADIO SET, AN/GRC-238
(BASE STATION)

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SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedure, and do not appear elsewhere in this manual. These Safety Summaries are recommended precautions that all personnel must understand and apply during any given phase of operation and maintenance. Each chapter has other specific warnings and cautions.

WARNING

KEEP AWAY FROM LIVE CIRCUITS

Personnel must at all times observe all safety regulations. Do not replace components or make adjustments inside equipment with power turned on. Under certain conditions, dangerous voltages may exist when the power control is in the off position due to charges retained by capacitors. To avoid injury, always remove power and discharge and ground a circuit before touching it.

RESUSCITATION

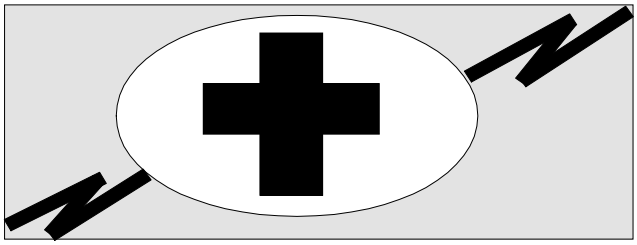
Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Director of Base Medical Services.

WARNING

VOLTAGES WITHIN THIS EQUIPMENT ARE HIGH ENOUGH TO ENDANGER LIFE.

Covers are *not* to be removed except by persons qualified and authorized to do so and these persons should always take extreme care once the covers have been removed.

WARNING



LITHIUM BATTERIES

Lithium oxide batteries or cells may be used to provide portable power for this equipment. They are potentially hazardous if misused or tampered with before, during or after discharge. The following precautions must be strictly observed to prevent possible injury to personnel or equipment damage.

Do not heat, incinerate, crush, puncture, disassemble, or otherwise mutilate the batteries.

Do not short-circuit, recharge, or bypass internal fuse.

Do not store batteries in equipment during long periods of non-use (in excess of 30 days).

Turn off the equipment immediately if you detect battery compartment becoming unduly hot, hear battery cells venting (hissing sounds), or smell irritating sulfur dioxide gas.

Page

2-9 WARNING - Before using hammer, place a wedge in top of hammer to ensure that head of hammer does not come loose.

3-2 WARNING - Before performing removal/replacement procedures, make sure power is removed from the unit. Failure to do so could result in personal injury or damage to the equipment.

6-11 WARNING - Before performing removal/replacement procedures, make sure power is removed from the unit. Failure to do so could result in personal injury or damage to the equipment.

2-1 CAUTION - Exercise care when removing assemblies from packing material in order to prevent damage to the unit.

2-7 CAUTION - Ensure proper use of safety tools (work gloves and hard hat) during assembly and disassembly of antenna.

3-2 CAUTION - Never apply pressure sensitive tape directly to connectors. This could damage connector pins.

3-2 CAUTION - Package all electrostatic discharge (ESD) sensitive assemblies in ESD bags before shipping or storing.

3-3 CAUTION - Rough handling can cause damage to electronic assemblies.

3-3 CAUTION - Electronic assemblies containing solid-state devices are susceptible to damage from static electrical discharges. Wear protective clothing and grounded wrist straps.

3-3 CAUTION - Forcing any misaligned electronic assembly into position may result in bent or broken pins.

3-3 CAUTION - Be very careful when removing or inserting an assembly into the equipment. If it is a plug-in CCA, be sure the guide pins are properly aligned before pressing the assembly in place. If the CCA tilts while being inserted, do not continue to press into position; straighten it, then apply even pressure to avoid tilting.

3-3 CAUTION - When repairing an electronic assembly, be careful that the tool employed does not inadvertently press against leads, pins, or other parts that are easily bent. Such pressure can destroy a good part and cause needless repair.

3-3 CAUTION - When handling an assembly that has been removed from its chassis, be careful not to press against the leads and pins. When removing an assembly, be sure to pull it straight out from the equipment. Do not cock, twist, pry, or jerk an electronic assembly to remove it from the mounting connector.

3-3 CAUTION - The base station contains components that are susceptible to damage by static electrical charges. Disassembly of the base station should only be done at a properly grounded work station.

6-11 CAUTION - The base station contains CCAs and components that are susceptible to damage by electrostatic discharge (ESD). Disassembly of the base station should only be done at a properly grounded work station. Use ESD precautionary procedures (wear grounding wrist straps) when touching, removing, and installing the modules.

6-11 CAUTION - Use care in removing and replacing CCAs to prevent damage to pins and sockets.

FOREWORD

This manual meets the technical content requirements of specification MIL-M-38798B, paragraph 3.3 (1 December 1975) and MIL-M-38807A (1 June 1982) and format requirements of specification MIL-M-38784B (16 April 1983) for Radio Set AN/GRC-238, commonly known as the base station.

a. Chapter 1 - General Information. This chapter provides general information for the base station including equipment description and purpose, leading particulars, capabilities and limitations, equipment supplied, equipment required but not supplied, optional equipment, special tools and test equipment, and related technical manuals.

b. Chapter 2 - Installation. This chapter provides complete installation instructions for the base station including installation logistics and installation procedure.

c. Chapter 3 - Preparation for Use and Reshipment. This chapter contains information which will permit operation and maintenance personnel to prepare the equipment for use, including reference to post-installation checkout procedures, preparing the unit for reshipment, packing, handling, and storage procedures.

d. Chapter 4 - Operation. This chapter provides complete operating instructions for the base station.

e. Chapter 5 - Theory of Operation. This chapter provides complete theory of operation for the base station.

f. Chapter 6 - Maintenance. This chapter provides all instructions required for on-equipment and off-equipment maintenance of the base station. Includes preventive maintenance procedures, troubleshooting procedures, and repair procedures.

g. Chapter 7 - Illustrated Parts Breakdown (IPB). Provides complete illustrated parts breakdown for the base station. The IPB prepared in accordance with MIL-M-38807A.

h. Chapter 8 - Circuit Diagrams. Contains interconnection diagrams and block diagrams.

i. Glossary - Provides definitions of the special terms and abbreviations used in the technical order.

j. Alphabetical Index - Provides cross-references to applicable paragraphs, figures or tables.

Legend for Figure 1-1:

1. Antenna, 30-88 MHz
2. Mast, Antenna, Base Station
3. Antenna, 136-174 MHz
4. Antenna, 403-470 MHz
5. Cable Assembly, Power Supply, 120 VAC (W1)
6. Cable Assembly, Power Supply, 240 VAC (W1)
7. Cable Assembly, Power Supply DC Input (W1)
8. Power Supply, Base Station
9. Cable Assembly, BS Power (W2)
10. Strap Assembly, Ground (W6)
11. Loudspeaker, External (U1810) TD 708/WP
12. Cable Assembly, Coaxial, Antenna (W3)(W4)
13. Headset w/Boom Microphone
14. Microphone, Dynamic
15. Receiver-Transmitter Set, Radio RT-1696/U(C)
16. Cable, Jumper
17. Base station unit
18. Primary Battery Tray

Cable Assembly, Programming (W5) (Not illustrated)

Figure 1-1. Radio Set AN/GRC-238
(Sheet 1 of 2)

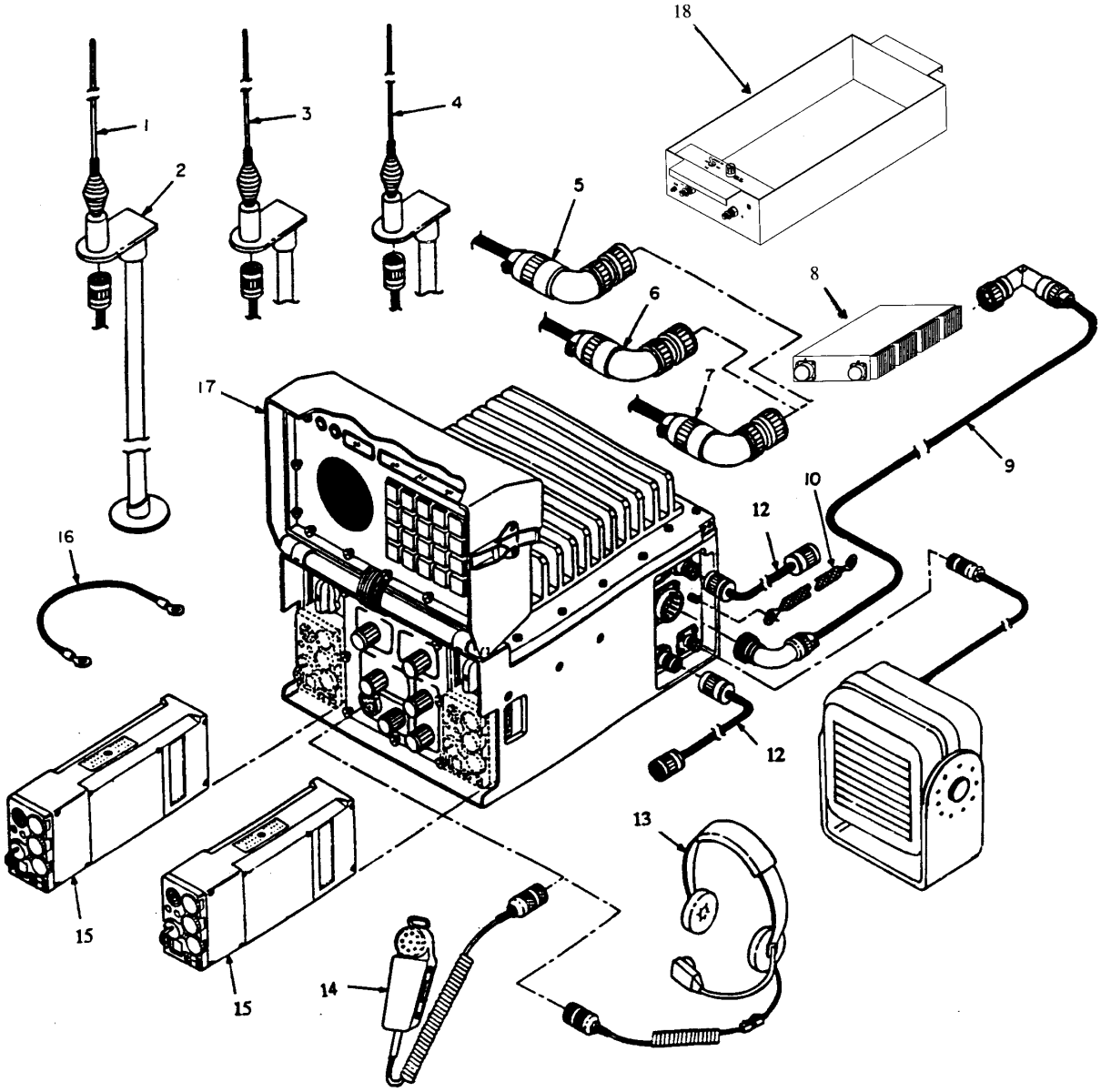


Figure 1-1. Radio Set AN/GRC-238
(Sheet 2 of 2)

CHAPTER 1 GENERAL INFORMATION

1-1 DESCRIPTION AND PURPOSE.

1-1.1 Equipment Function and Purpose.

Radio Set AN/GRC-238 (hereinafter referred to as the base station) is a multi-voltage frequency modulation (FM) receiver-transmitter that can transmit on one channel while simultaneously monitoring a second channel. The base station is capable of providing two-way (transmit and receive) communication in the 30-88, 136-174, or 403-470 Megahertz (MHz) frequency bands. Communication can be in either secure or non-secure modes. The base station uses analog FM in the non-secure mode and encrypted digitized voice FM in the secure mode.

The ability of the base station to transmit while simultaneously monitoring a guard channel is provided by two RT-1696/U(C) Receiver-Transmitter Set, Radios (hereinafter referred to as the receiver-transmitters). The base station is interoperable with other receiver-transmitters including the AN/PRC-77 Manpack Radio, Radio Set AN/PRC-128, and very high frequency (VHF) FM single channel mode of the SINCGARS-V. The base station also provides compatibility with FED-STD-1023, 12 kilobits/second (kbps) receiver-transmitters. For operation and maintenance information for Receiver-Transmitter Set, Radio RT-1696/U(C) refer to TO 31R2-2PRC139-1.

1-1.2 Equipment Description.

(See Figure 1-1.) The base station includes a base station unit, two plug-in receiver-transmitters and two mast-mounted antennas (one for main and one for guard) for each frequency band, a power supply assembly, various audio assemblies (microphone, headset, loudspeaker), a primary battery tray, and several cable assemblies. The base station can be installed in any building or structure meeting the electrical power and environmental requirements specified in Table 1-2 and allowing for placement of antennas to provide unobstructed radio propagation paths to all remote locations with which communication is required. These items are covered in more detail in paragraphs 1-1.2.1 through 1-1.2.6 below.

1-1.2.1 Base Station Unit.

(See Figure 7-2.) The base station unit includes three circuit card assemblies (CCAs) which are accessible through a removable cover on the underside of the unit - the reference oscillator CCA (A1) (45), the control interface CCA (A2) (44), and the audio interface CCA (A3) (43). These CCAs plug into a parent board (A4) (50) which interfaces with control panel assembly (A5) (5), power amplifier assembly (A6) (19), harmonic filter assembly (A7) (30), operator panel (A12) (52), the base station power supply assembly (8, Figure 7-1), and two plug-in receiver-transmitters (15, Figure 7-1). The receiver-transmitters plug into sleeves located on the left and right side of the control panel of the base station unit. The power amplifier (A6) (19) mounts on a heat sink on top of the unit. The operator panel is hinged so that it can be closed and latched when the unit is not in use.

1-1.2.2 Receiver-Transmitters.

(See Figure 1-2.) The two plug-in receiver-transmitters included with the base station are the same receiver-transmitters used by Radio Set AN/PRC-139(C). One receiver-transmitter provides the operator with a primary channel for routine traffic. This is referred to as the main receiver-transmitter. The other receiver-transmitter provides a guard or emergency use channel which constantly monitors for traffic on the tuned guard channel. This is referred to as the guard receiver-transmitter. Each receiver-transmitter includes three interchangeable transceiver modules and a hand-held radio chassis. Use of the interchangeable transceiver modules provides the capability of operating at all frequencies within the 30-88, 136-174, or 403-470 MHz frequency bands. The operating band of the receiver-transmitter is determined by the transceiver module installed. The transceiver module is enclosed within the rear cover assembly of the receiver-transmitter. When the transceiver modules are changed, the base station must be connected to the corresponding antenna. The proper configurations are listed in Table 1-1.

Table 1-1. Receiver-Transmitter Configurations Vs Frequency Band

Frequency Band	Receiver-Transmitter Transceiver Module	Antenna
30-88 MHz	SS-4100820-501	4242-MK2-RAC
136-174 MHz	SS-4100821-501	4265-RAC
403-470 MHz	SS-4100822-501	4266-RAC

Legend for Figure 1-2:

1. 2, 3.	Transceiver module
4.	Hand-held radio chassis

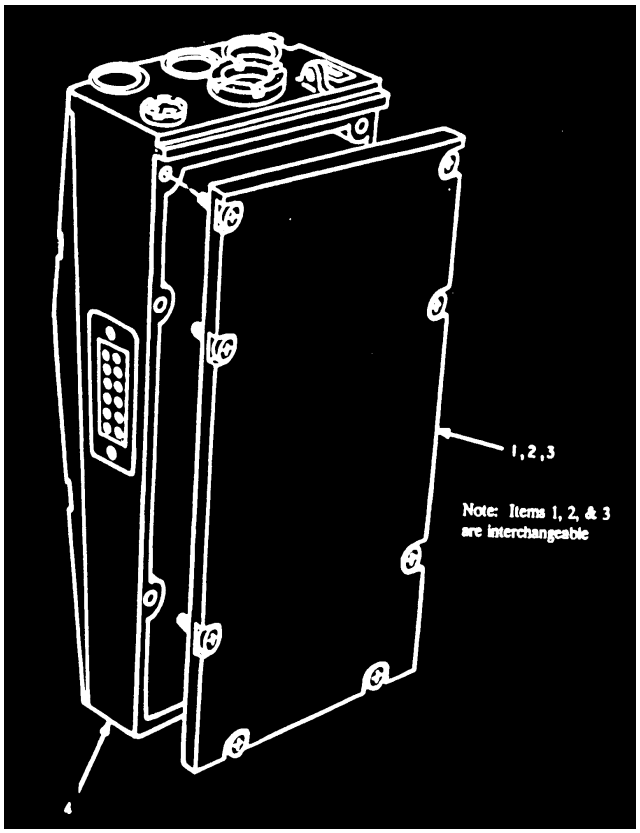


Figure 1-2. Receiver-Transmitter Set RT-1696/U(C)

1-1.2.3 Antenna Assembly.

(See Figure 1-3.) The antenna assembly provides full-duplex transmit and receive frequency coverage over the three frequency bands. Six antennas are provided to cover the three frequency bands, two antennas for each of the three frequency bands.

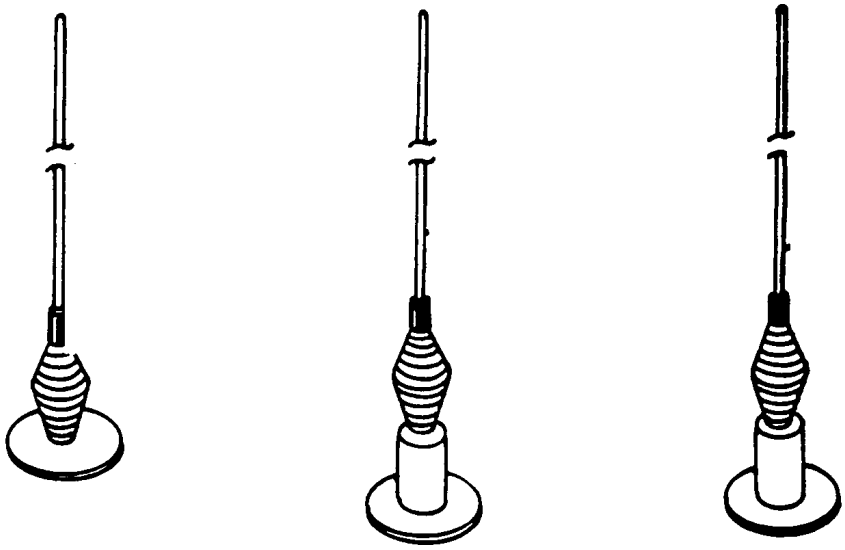


Figure 1-3. Antenna System

Masts are supplied with the antennas to elevate the antennas up to 30 feet (in 5 foot increments) to increase transmission range and quality of transmitted and received signals.

1-1.2.4 Power Supply Assembly.

(See Figure 1-4.) The power supply provides regulated power for the operation of the base station. The power supply operates from any of the following power sources:

a. 120/240 VAC "10% (single phase, three wire) 50-60 Hz
b. 220 VAC "10% (single phase, two wire) 50 Hz
c. 12 VDC (+4V/-2V)
d. 24 VDC (+8V/-4V)

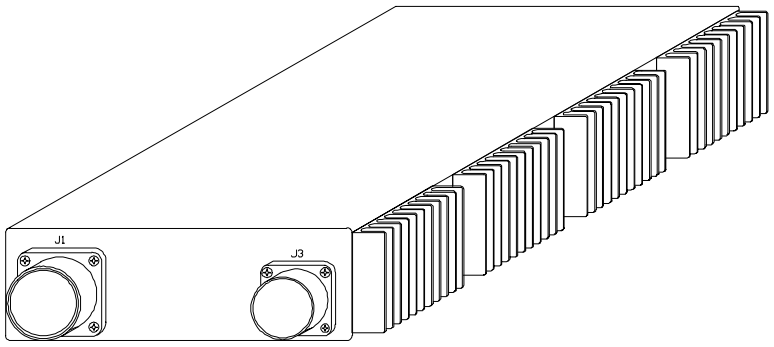


Figure 1-4. Power Supply Assembly

1-1.2.5 Audio Accessories.

The operator has the option of several handsets/headsets and an external loudspeaker (see Figure 1-5). The internal or external loudspeaker provides audio output for guard and main receive signals originating from the receiver-transmitter. A dynamic microphone (SS-3100520-501) (see Figure 1-6) requires that either the internal or external loudspeaker be used with the base station. A headset with boom microphone (see Figure 1-7) allows the operator to more effectively operate the equipment in a noisy environment or to turn off both the internal and external loudspeaker (using the speaker switch) for more covert operation. The boom microphone reduces noise. Transmission control is via a push-to-talk (PTT) switch that is located on a belt-worn control box. The dynamic microphone and the headset are provided with cable assemblies, one of which can be connected to the HEADSET connector on the base station at any one time. The external loudspeaker is provided with a cable assembly that connects to the EXT SPKR connector on the rear panel of the base station.

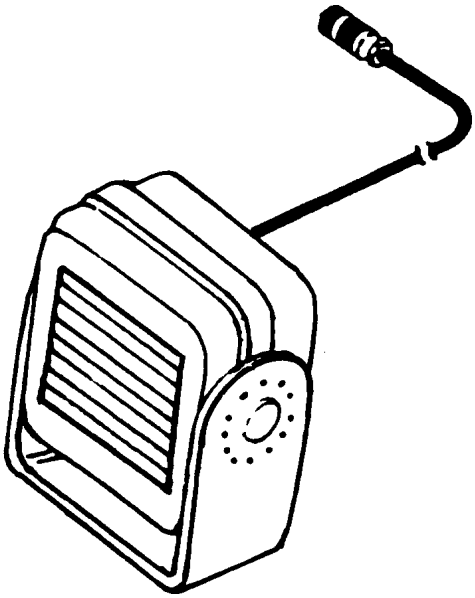


Figure 1-5. External Loudspeaker

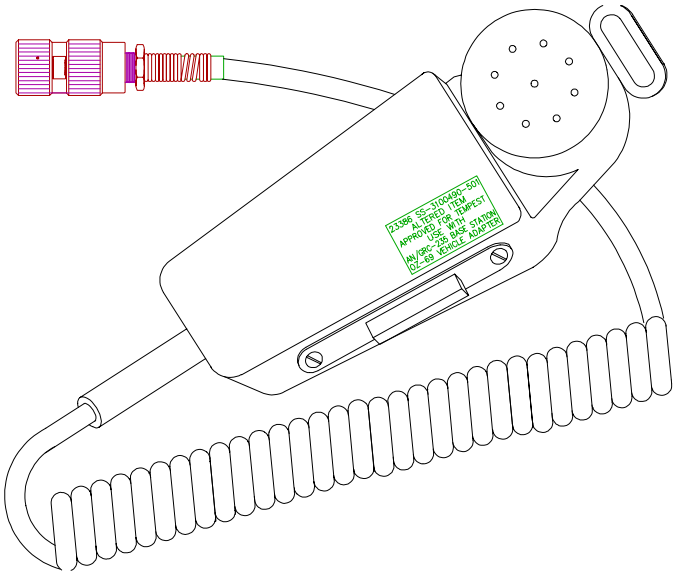


Figure 1-6. Dynamic Microphone

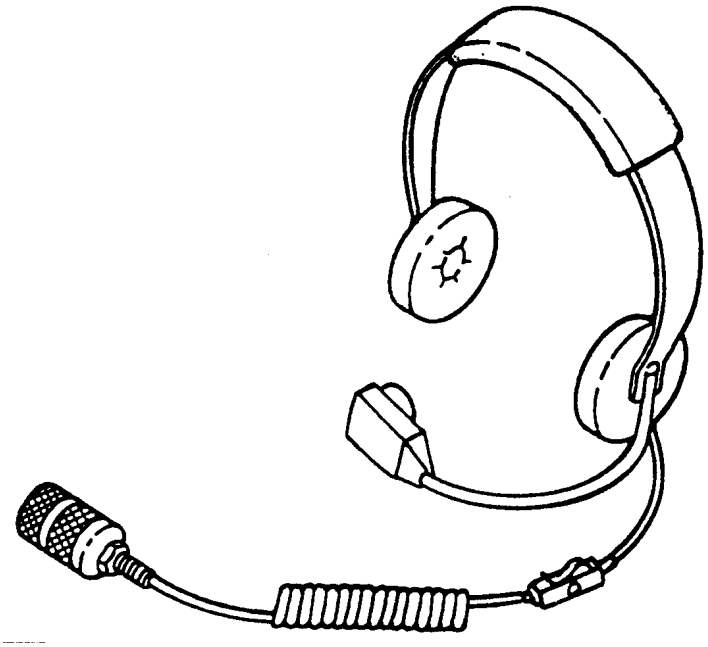


Figure 1-7. Headset with Boom Microphone

1-1.2.6 Primary Battery Tray.

(See Figure 1-8) The base station includes a primary battery tray for operation in remote locations with no external power source. The tray consists of two battery holders with connectors in the bottom to hold a total of 12 BA-5590 lithium batteries. The connectors are mounted on an underlying circuit board that interconnects the batteries through an ON/OFF switch and 20 amp fuse to positive and negative terminals. The base station unit is connected to the battery tray using the DC power input cable (SS-4500106-501). The battery tray also has a grounding post.

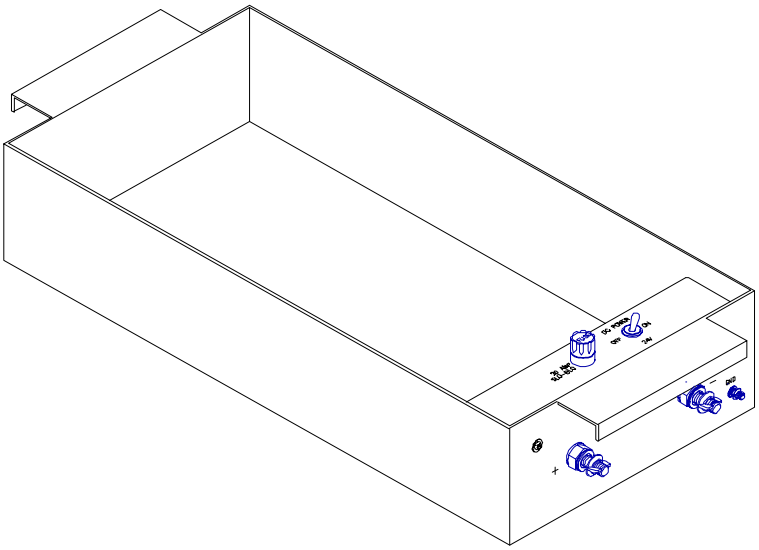


Figure 1-8. Primary Battery Tray Assembly

1-2 LEADING PARTICULARS.

Leading particulars for the base station are given in Table 1-2.

Table 1-2. Leading Particulars

Characteristic	Parameter
Equipment dimensions and weight:	
Base Station Unit	
Length	14.50 inch (in.) (36.83 centimeters (cm))
Width	10.00 in. (25.40 cm)
Height	7.5 in. (19.05 cm) (operator panel closed) 12.0 in. (30.48 cm) (operator panel open)
Volume	1,087.5 cubic (cu) in. (17,821 cu cm)
Weight (with radio installed)	26.5 lbs. (12.1 kilograms (kg))
Power Supply Assembly	
Length	12 in. (30.48 cm)
Width	10 in. (25.40 cm)
Height	3 in. (7.62 cm)
Volume	360 cu in. (5,899 cu cm)
Weight	9.75 lbs. (4.43 kg.)
Environmental requirements:	
Temperature:	0° Celsius (C) (32° Fahrenheit (F)) to +49°C (120°F)
Operating	-51°C (-60°F) to +68°C (155°F)
Storage	0 to 95 percent relative humidity
Humidity	
Electrical power requirements:	
DC source	12 volts direct current (VDC) (-2 VDC, +4 VDC) or 24 VDC (-4 VDC, +8 VDC)
or	
AC source	120/240 VAC " 10% (single phase, 3 wire) at 50-60 Hertz (Hz) 220 VAC (single phase, 2 wire) "10% at 50 Hz

1-3 CAPABILITIES AND LIMITATIONS.

Capabilities and limitations of the base station are given in Table 1-3.

Table 1-3. Capabilities and Limitations

Characteristic	Parameter
Frequency Range (Main and Guard):	30-88 MHz 136-174 MHz 403-470 MHz
Transmitter Output	5, 16, and 40 watts selectable (main) 2 watts (guard)
Security	TEMPEST compliant INDICTOR chip
Interoperability	AN/PRC-77 Manpack radio AN/PRC-128 hand-held radio SINCGARS-V (VHF-FM single channel radio) 12.5 kHz Bandwidth analog FM radios (clear mode only) 25 kHz Bandwidth analog FM radios (clear mode only) FED-STD-1023 compatible, 12 kbps VINSON (KY-57) compatible, 16 kbps
Channels (receive and transmit)	14 channels individually programmable for main and for guard
Channelization	25 kilohertz (kHz) bandwidth on all frequency bands (secure transmission capable) 12.5 kHz bandwidth (non-secure only) on 136-174 MHz and 403-470 MHz bands 12.5 kHz tuning steps
Adjacent Channel Selectivity	50 decibels (dB) over 30-88 MHz, 25.0 kHz Bandwidth 52 dB over 136-174 MHz, 12.5 kHz Bandwidth 60 dB over 136-174 MHz, 25.0 kHz Bandwidth 40 dB over 403-470 MHz, 12.5 kHz Bandwidth 48 dB over 403-470 MHz, 25.0 kHz Bandwidth
Sensitivity	-113 power in decibels (relative to 1 milliwatt) (dBm) or 0.5µV for 12 dB SINAD
Spurious Response and Image Rejection	65 dB over all three bands
Intermodulation Spurious Response	60 dB over all three bands

1-4 EQUIPMENT SUPPLIED.

Equipment supplied with the base station system is listed in Table 1-4.

Table 1-4. Equipment Supplied

Official Nomenclature	Part Number	Quantity
Base Station Unit	SS-4100804-501	1
Receiver-Transmitter Set, Radio RT-1696/U(C)	SS-4100807-502	2
Antenna, 30-88 MHz	4242-MK2-RAC	2
Antenna, 136-174 MHz	4265-RAC	2
Antenna, 403-470 MHz	4266-RAC	2
Mast, Antenna, Base Station	SP30SS	2
Power Supply Assembly	CPS3263	1
Headset w/Boom Microphone	HS-711 SS	1
Microphone, Dynamic	SS-3100520-501	1
Loudspeaker, External	Z3344	1
Cable Assembly, Coaxial, Antenna	CPRG214-100-UHF/VHF	2
Cable Assembly, Base Station Power	SS-3500274-501	1
Cable Assembly, Programming	SS-3500276-501	1
Strap Assembly, Ground	SS-3500279-501	1
Cable Assembly, Power Supply, 120 VAC	SS-4500104-501	1
Cable Assembly, Power Supply, 240 VAC	SS-4500105-501	1
Cable Assembly, Power Supply Direct Current (DC) Input	SS-4500106-501	1
Cable, Jumper	SS-2500116-501	1
Primary Battery Tray	SS-4100954-501	1

1-5 EQUIPMENT REQUIRED BUT NOT SUPPLIED.

All equipment required for operation of the base station is supplied.

1-6 SPECIAL TOOLS AND TEST EQUIPMENT.

There are no special tools or test equipment required for maintenance of the base station.

1-7 RELATED TECHNICAL MANUALS.

Table 1-5 lists related technical manuals.

Table 1-5. Related Technical Manuals

Publication Number	Publication Title
31R2-2PRC139-1	Operation and Maintenance Instructions with Illustrated Parts Breakdown (Organizational Level) for Radio Set AN/PRC-139(C) (includes Receiver-Transmitter RT-1695/TRC-199, Receiver-Transmitter RT-1696/U (C), Programmer Unit, Frequency, Radio MX-11531/U, Battery Chargers, and Battery Reconditioner)
31R2-2TRC199-1	Operation and Maintenance Instructions with Illustrated Parts Breakdown (Organizational Level) for Radio Set AN/TRC-199
31R2-4-1085-1	Operation and Maintenance Instructions with Illustrated Parts Breakdown (Organizational Level) for Adapter Group, Radio OF-228/U
31R2-2PRC139-06	Work Unit Code Manual
KAM-330	Operating Instructions for KOI-18 and KYK-13 COMSEC Fill Devices
ON477340	AN/CYZ-10 Data Transfer Device Users' Manual

CHAPTER 2 INSTALLATION

2-1 INTRODUCTION.

This section is divided into two sections. Section I. Installation Logistics provides information for site preparation, unloading, unpacking and inspections, housing, receiving data, material handling, cabling required for installation into buildings and other supporting structures. Section II. Installation Procedures lists tools and equipment required for field installation and describes the installation sequence.

NOTE
CONTROLLED CRYPTOGRAPHIC ITEM

The receiver-transmitter used in the base station is a controlled cryptographic item (CCI). Consult your Communications Security (COMSEC) manager for security procedures.

Section I. INSTALLATION LOGISTICS

NOTE

Installation of the base station antennas requires a minimum of two people.

2-2 SITE PREPARATION.

The base station can be installed in any building or structure meeting the electrical power and environmental requirements specified in Table 1-2. However, antennas shall not be installed closer to power and telephone lines than two antenna lengths. Install main and guard antennas as far apart from each other as possible.

2-3 UNPACKING AND INSPECTIONS.

CAUTION

Exercise care when removing assemblies from packing material in order to prevent damage to the unit.

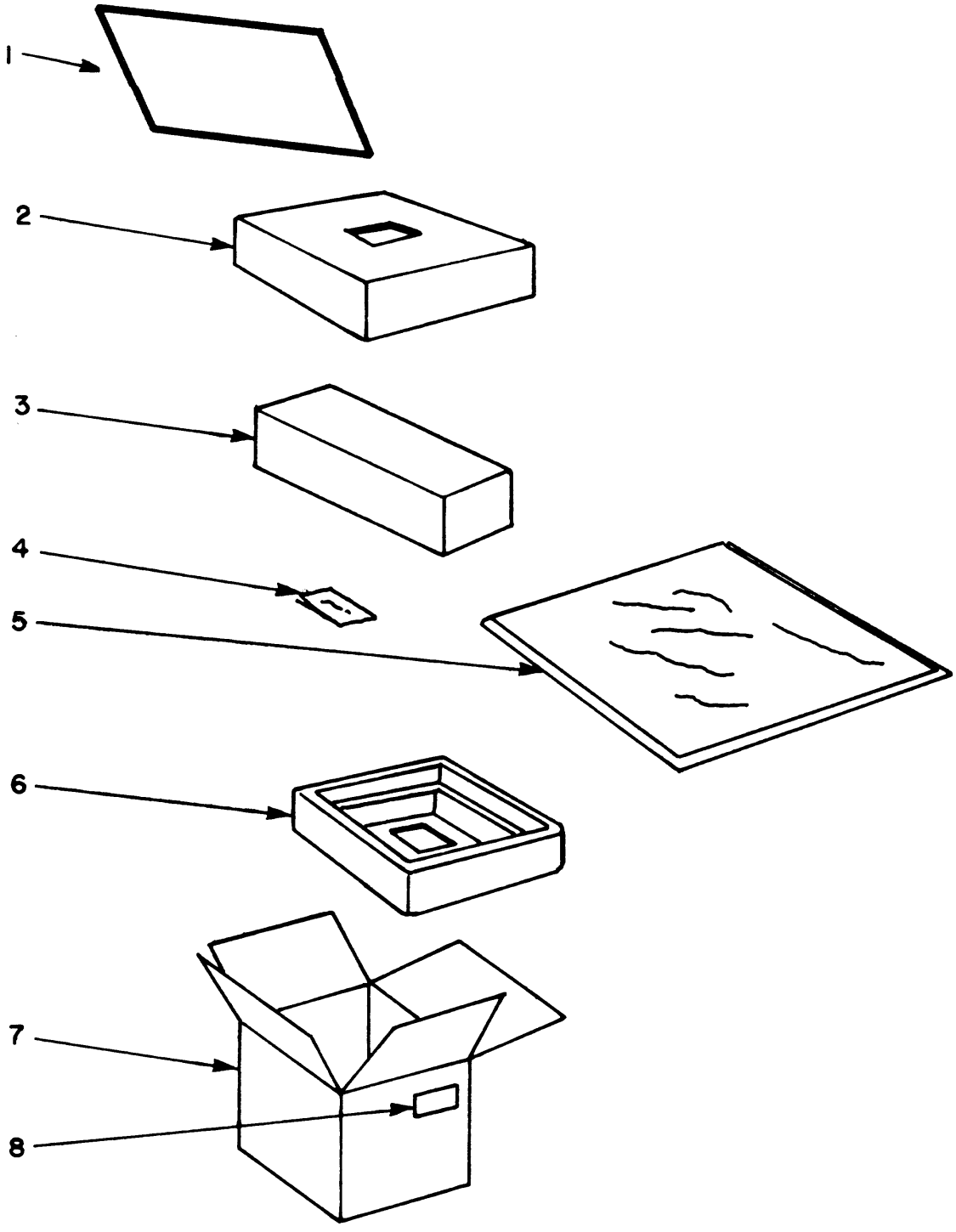
NOTE

The following procedure describes unpacking of the base station unit. The base station unit and other items of the base station are shipped in individual cutouts in a large foam-filled container.

To unpack the base station, remove the unit and any equipment from the carton and store the packing carton for reuse/shipment. Packing instructions are given in Chapter 3. Inspect contents for completeness, integrity, and damage. Contents shall be in accordance with the packing slip and the list of supplied equipment in Table 1-4.

Refer to Figure 2-1 as a guide in performing the following unpacking procedures:

a. Open the top of the fiberboard box (7, Figure 2-1) and remove the operating instructions (1) and polystyrene top (2) from container.



Legend for Figure 2-1

1.	Operator instructions	5.	Barrier bag
2.	Polystyrene top	6.	Polystyrene bottom
3.	Base station unit	7.	Fiberboard box
4.	Desiccant bag	8.	Packing slip

Figure 2-1. Packaging Diagram for the Base Station

b. Remove barrier bag (5) from the box.

c. Remove the base station unit (3) from foam insert. Remove remaining components from foam insert.

d. Remove packing slip (8) from the plastic envelope on the fiberboard box and check to ensure that all items listed on the packing slip were received.

e. Store all packing materials (except desiccant) in shipping container and store shipping container for re-use. Discard original desiccant. New desiccant material must be used when packing.

f. Inspect top and bottom, both sides, and front and rear panels of equipment for dents, scratches or any visually identifiable damage.

g. Open the operator panel by releasing the latches on either side and pulling forward and up on the handle (see Figure 1-1).

h. Inspect controls and indicators on front panel and operator panel for missing, broken or cracked knobs or levers and note any discrepancies. Report any discrepancies using standard material reporting procedures.

2-4 HOUSING.

If necessary to store the base station for an extended period of time before installation, proceed as follows:

NOTE
COMMUNICATIONS SECURITY

Ensure that base station receiver-transmitters are zeroized (mode control switch on the receiver-transmitter turned to Z position) before placing the base station in storage. This will ensure that the keys installed in the receiver-transmitters are not compromised.

a. Clean the base station before placing in storage. Refer to paragraph 6-3.3.2.

b. Disconnect antennas and accessories before placing the base station unit in storage.

c. Ensure that no COMSEC variables are present.

NOTE

The temperature of the storage area must be within the range -51EC (-60EF) to +68EC (155EF).

2-5 RECEIVING DATA.

Table 2-1 identifies the contents and particulars of the shipping container.

Table 2-1. Base Station Packaging

Description	Dimensions (in)			Weight(lb)
	W	H	D	
Radio Set AN/GRC-238 (Base Station)	32	29	70	245.0

2-6 MATERIAL HANDLING.

No material handling equipment is required in the installation of the base station.

2-7 CABLES.

Table 2-2 lists all base station interconnecting cables. Refer to FO-1 for base station interconnect diagram.

Table 2-2. Base Station Interconnecting Cables

Cable Designation	Cable Part No.	Description	Use
W1	SS-4500104-501	Cable Assembly, Power Supply, 120 volts alternating current (VAC) Input	Connects base station to 120 VAC
W1	SS-4500105-501	Cable Assembly, Power Supply, 240 VAC Input	Connects base station to 240 VAC
W1	SS-4500106-501	Cable Assembly, Power Supply, DC	Connects base station to 10-32 volts direct current (VDC)
W2	SS-3500274-501	Cable Assembly, Power	Connects power supply DC output to base station
W3	SS-1600290-1	Cable Assembly, Coaxial, Antenna	Connects main antenna to base station
W4	SS-1600290-1	Cable Assembly, Coaxial, Antenna	Connects guard antenna to base station
W5	SS-3500276-501	Cable Assembly, Programming	Connects RS-232C input/output to the base station for receiver-transmitter programming
W6	SS-3500279-501	Strap Assembly, Ground	Connects base station to external ground
W7	SS-2500116-501	Cable Jumper	Connects two lead-acid 12 VDC batteries in series for external DC power.

2-8 BUILDINGS AND OTHER SUPPORTING STRUCTURES.

Buildings or other structures in which the base station is to be installed must meet the electrical power and environmental requirements listed in Table 1-2. The area in which the base station is installed must be adequate to accommodate the open dimensions of the base station unit plus at least 6 inches of side clearance for cable connection. There should be space nearby for the power supply.

Section II. INSTALLATION PROCEDURES

2-9 TOOLS AND EQUIPMENT REQUIRED FOR FIELD INSTALLATION.

Tools and equipment required for installation of the base station are listed and described in the following paragraphs.

2-9.1 Tools.

All tools required for installation of the base station are described in Table 2-3.

Table 2-3. Base Station Tools

Official Nomenclature	Part Number/ Designation	Qty	Use
Flat blade screwdriver	R5323	1	Used to fasten the programming cable to J1 on the base station side panel.
Hammer	Q76 (1BZ19)	1	Used when installing the main and guard antennas (supplied with the antenna mast kit).

2-9.2 Equipment.

No equipment is required for installation.

2-10 INSTALLATION SEQUENCE.

NOTE

The base station is shipped from the factory configured for 30-88 MHz operation, with the appropriate receiver-transmitters. If using a different configuration, substitute the appropriate antenna and receiver-transmitter. Refer to Chapter 6 for antenna and receiver-transmitter removal and replacement. Refer to TO 31R2-2PRC139-1 for changing receiver-transmitter configuration.

2-10.1 General.

Installation of the base station involves the following tasks:

a. Setting up main and guard antennas (see paragraph 2-10.2).

b. Installing base station unit (see paragraph 2-10.3).

c. Installing power supply (see paragraph 2-10.4).

d. Installing external loudspeaker (optional) (see paragraph 2-10.5).

e. Raising base station operator panel (see paragraph 2-10.6).

f. Installing main and guard receiver-transmitters (see paragraphs 2-10.7 and 2-10.8).

g. Establishing electrical connections (see paragraph 2-10.9).

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2-10.2 Antenna/Mast Installation.

(Refer to Figure 2-2.) Install the antenna mast and selected antenna as follows:

CAUTION

Ensure proper use of safety tools (work gloves and hard hat) during assembly and disassembly of antenna.

NOTE

The assembled antenna base section/antenna adapter will fit in the mast transit bag (3) so that step a may be carried out prior to field deployment, if required. When erecting the antennas in high winds, ensure that a minimum of three personnel are used.

a. Bolt the antenna base section (1, Figure 2-2) to the antenna adapter (2) and connect the antenna ground strap to its terminal.

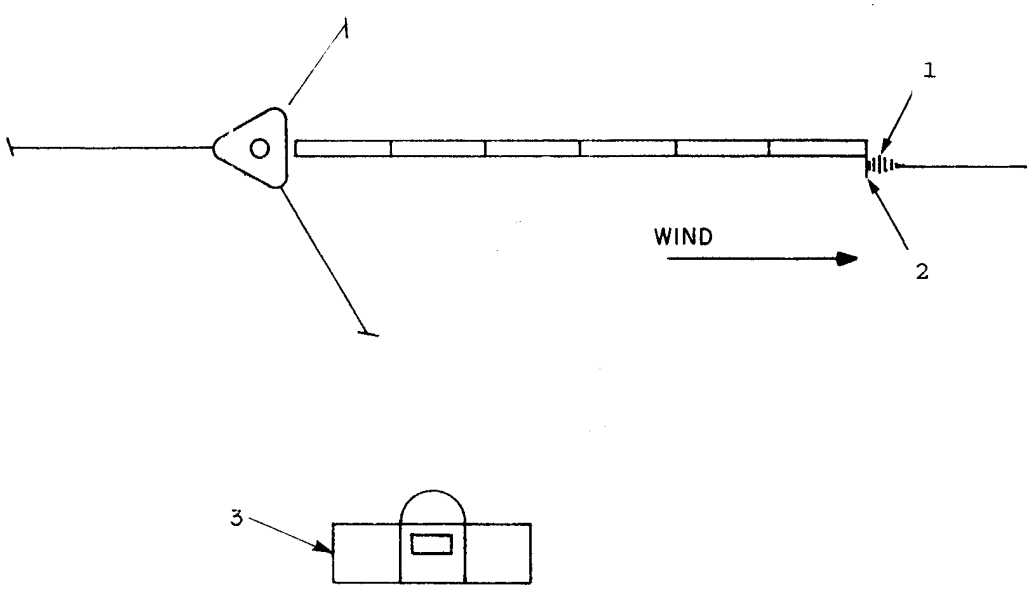


Figure 2-2. Antenna Mast/Antenna Installation - Step 1 of 7

b. Select an unobstructed site. Under windy conditions mast raising is made easier if the mast is laid out on the ground with the base of the mast pointed into wind.

c. Remove all mast sections (4) and the guy plate (5) from the transit bag (3). Note that the socketed end is the lower end of each tube section. Place the tubes in line along the ground. Assemble two tube sections together, then slide on the guy plate so that it rests on the shoulders of the fourth tube. Complete the mast body with the remaining two tubes.

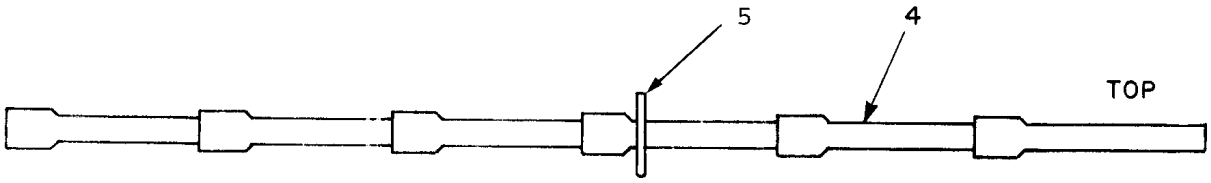


Figure 2-3. Antenna Mast/Antenna Installation - Step 2 of 7

d. Remove the base plate (6), two ground spikes (7), and hammer from the transit bag. Place the base plate at the mast base, arrowhead style, with front arrow pointing into the wind, so that the socketed lower end of the mast will engage in the heel. Secure the base plate by driving the two ground spikes through the holes.

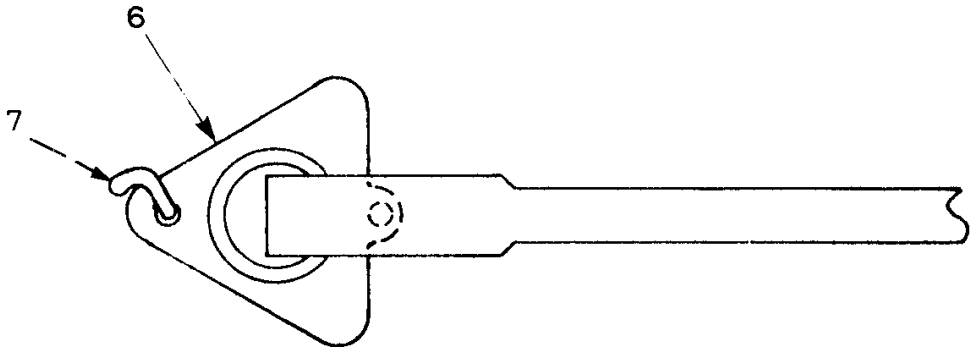


Figure 2-4. Antenna Mast/Antenna Installation - Step 3 of 7

e. Fit and secure top antenna section to antenna/adapter assembly. Connect the top coaxial cable connector to antenna and attach cable strain relief to hole in web of adapter. Rest flat edge of adapter on ground to provide convenient access to guy rope attachment points. Unwind cable (8) along length of mast and secure to mast at intervals not exceeding 8 feet (i.e., every one and one half tube sections). Secure using tape (user supplied).

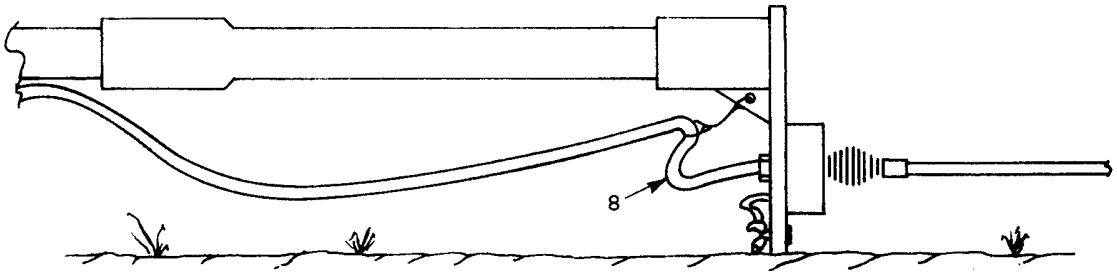


Figure 2-5. Antenna Mast/Antenna Installation - Step 4 of 7

WARNING

Before using hammer, ensure a wedge is placed in the top of the hammer to ensure that head of hammer does not come loose, thereby endangering personnel.

f. Remove three middle guy rope assemblies (black) and three ground anchors from the transit bag (3). Disconnect the first (fixed) snap hook off the winder and temporarily connect it to the base plate. Carrying the hammer and one of the ground anchors, walk directly away from the mast, in the direction that the arrow head is pointing, unwinding the guy rope as you go, until the ground anchor red radius marker is reached. Drive in ground anchor at 20E angle to the vertical.

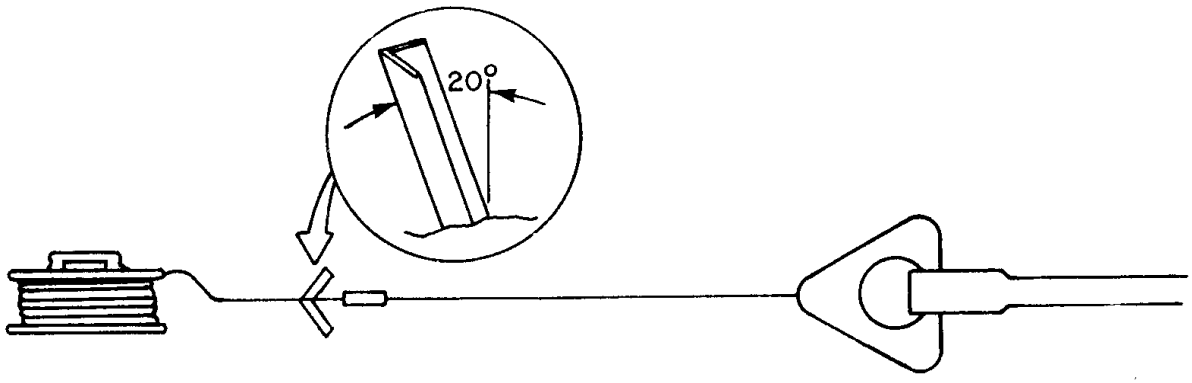


Figure 2-6. Antenna Mast/Antenna Installation - Step 5 of 7

g. Using the same guy rope as a radius guide, walk around the base plate through a 120E angle from the first ground anchor by using the triangular shape of the base plate as a reference. Drive in ground anchor 2 at this point.

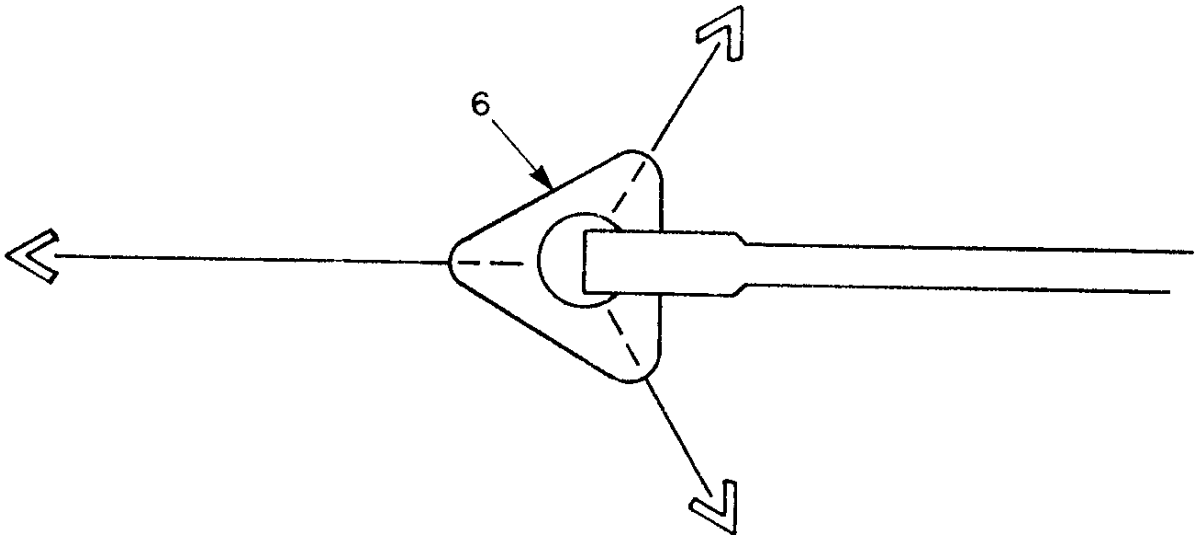


Figure 2-7. Antenna Mast/Antenna Installation - Step 6 of 7

CAUTION

h. Repeat step g for ground anchor 3.

i. Disconnect the guy rope that has been used for a radius marker. Attach the fixed (upper) snap hook to the mid level guy plate. Attach the running hook at the lower end to ground anchor 2. Leave the winder attached to the lower ends of the guy rope to prevent accidental loss .

j. Take a second (black) middle level guy rope. Attach the fixed (upper) snap hook to the mid level guy plate. Attach the movable hook at the lower end to ground anchor 3.

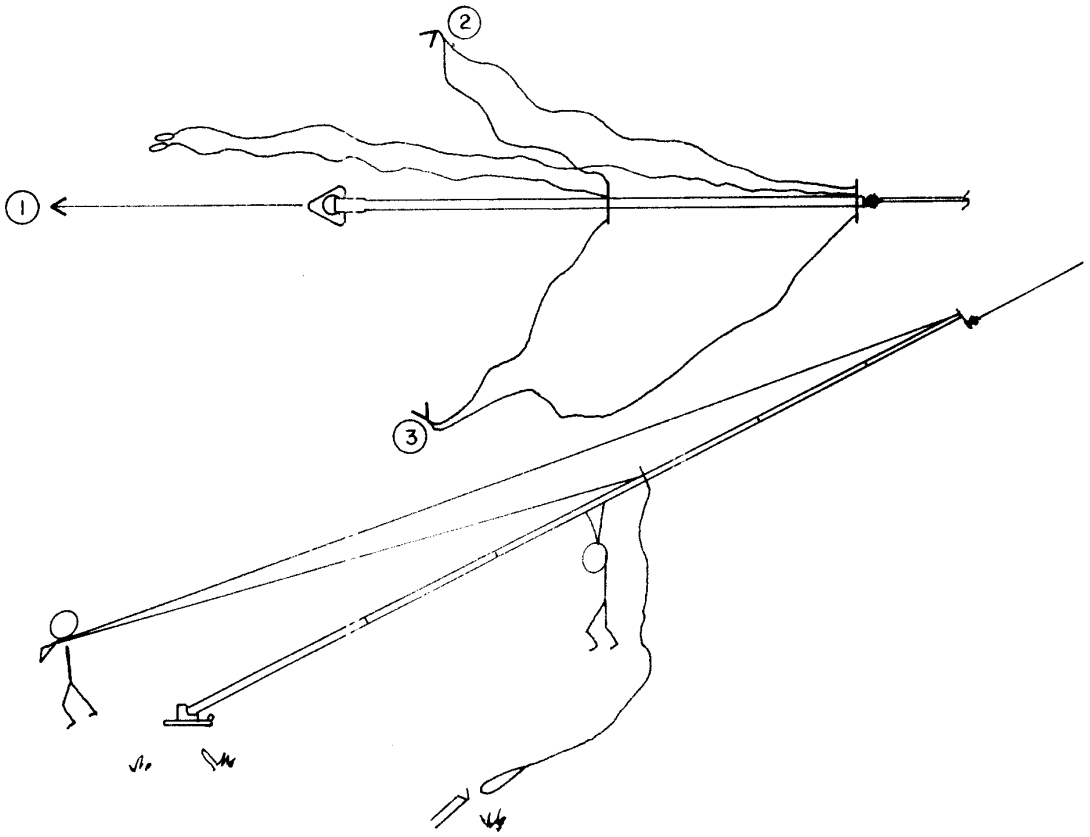
k. Attach the upper snap hook of the third middle level guy rope to the guy plate. Unwind the rope along the length of the mast toward the ground anchor 1, but do not attempt to attach the lower end yet.

NOTE

Middle guys should be attached to lower hole closest to mast. Upper guys should be attached to upper hole on same side.

l. Attach the top guy rope to the antenna adapter and ground anchors in the same way. Ensure that guy ropes will not snag coaxial cable when mast is raised.

NOTE



When raising antenna, ensure that guy ropes do not become entangled.

Figure 2-8. Antenna Mast/Antenna Installation - Step 7 of 7

When raising or lowering the mast, be sure to maintain equal tension on the mid and upper guy ropes. Allowing either one to go slack may result in the mast bowing and create high load levels on the mast tubes.

m. Ensure foot of mast is securely located in hole in center of base plate. While second person raises mast over his head and walks toward base plate, pull on mid and upper guy ropes to raise mast into vertical position. Attach free guy ropes to ground anchor 1 and tighten all ropes.

n. Connect the coaxial antenna cable (SS-1600315-1) to the connector at the back of the base station. (Refer to FO-1.)

2-10.3 Alternate Antenna/Mast Mounting.

The following paragraphs provide alternative means of mounting the antennas. These include roof and tripod mount, or side of building mount. All mounting hardware and tools are user provided. Any additional mounting situations will vary depending on user requirements.

2-10.3.1 Roof Mount.

(Refer to Figure 2-9) The roof mount can be used on peaked or flat type roofs. The suggested height limitation is 10 feet above the rooftop. Use a "universal" type of mounting bracket for this type of mount. One clamp type bracket with three or four guy wires equally spaced around the mast and anchored to the roof or eaves by eyebolts. Apply roofing compound around the base of the bracket, screws, and eyebolts for moisture sealing.

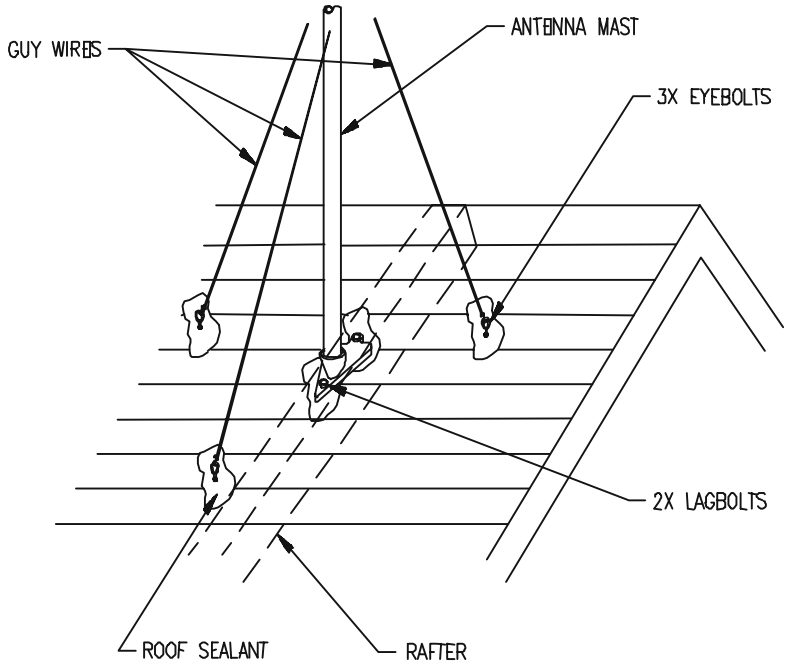


Figure 2-9 Roof Mounting

2-10.3.2 Tripod Mount.

(Refer to Figure 2-10) The tripod mount can be used on peaked or flat type roofs. The suggested height limitation is 10 feet above the rooftop. Installations involving a tripod mount and mast should be guyed if the mast is ten feet or more. Tripod mount must be securely anchored to the roof as should the guy wires. Apply roofing compound around the base of the bracket, screws, and eyebolts for moisture sealing.

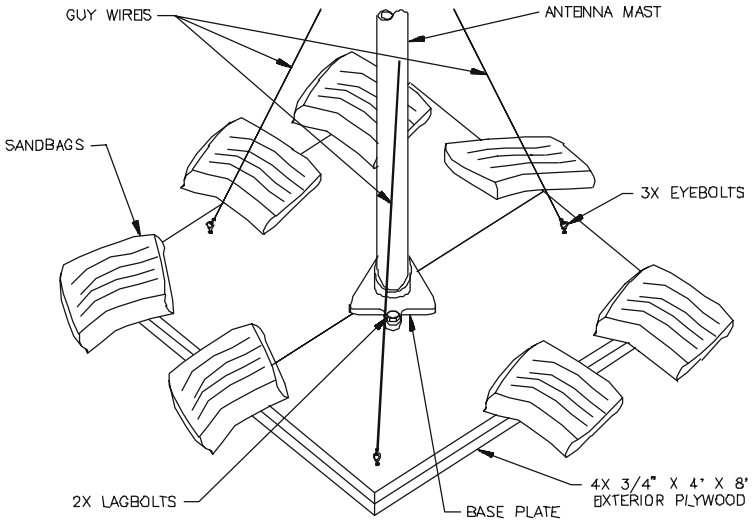


Figure 2-10. Tripod Mounting

2-10.3.3 Side of Building Mount.

(Refer to Figure 2-11) Side roof mounting is used on the side of the structure. The suggested height limitation is 10 feet above roof top. Where the roof overhang is not excessive, the side of the building provides a convenient mounting. Position the bracket over a stud, if possible, one above the other, and space two or three feet apart. For metal siding, first mark mounting holes, then drill pilot holes through the siding to accept the mounting screws.

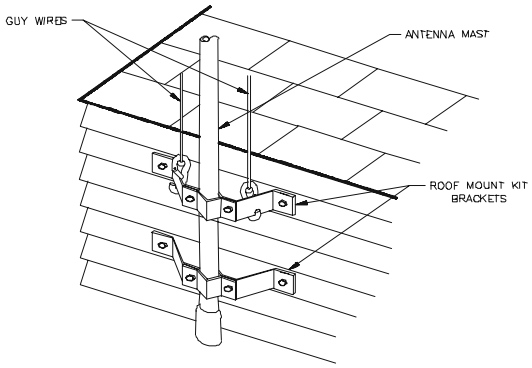


Figure 2-11. Side of Building Mounting

2-10.4 Installing Base Station Unit.

Install the base station unit as follows:

a. Select a flat, level surface on which to place the base station unit.

b. Ensure that there is adequate clearance on the right side of the unit for all cable connections.

c. Ensure that antenna coaxial cables can be easily routed to the selected antenna mast site.

d. Ensure that the power supply can be installed nearby (within 6 feet).

e. Establish electrical connections as described in paragraph 2-10.10.

2-10.5 Installing Power Supply Assembly.

Install the power supply assembly as follows:

a. Select a flat, level surface within 6 feet of the base station unit and close to the selected AC or DC power source.

NOTE

Connection to an AC power source that contains Ground Fault Interrupt (GFI) circuit protection devices rated at less than 15 milliamps may result in circuit interruption.

b. Establish electrical connections as described in paragraph 2-10.10

2-10.6 Installing External Loudspeaker.

Install the external loudspeaker as follows:

a. Select a mounting location within 3 feet of the base station.

b. The external loudspeaker has a mounting bracket that can be used for semi-permanent installation on either horizontal or vertical surfaces. To install the bracket, first rotate the speaker perpendicular to the bracket. Drill an appropriate size hole in the selected mounting surface (exact hole size will depend on the size of the screw selected to hold the bracket - screw not supplied).

c. Place the screw through the hole in the bracket and screw into the starter hole.

2-10.7 Raising Base Station Operator Panel.

Raise the base station operator panel as follows:

a. Release the retaining clips on either side of the operator panel by turning the wings approximately 90E.

b. Grasp the handle on the operator panel and pull up and out.

c. Rotate the operator panel around the top hinge until the back of the panel clicks into the open position.

NOTE

Disconnect any audio accessory from the receiver-transmitters before installation in the base station.

NOTE

Under normal operating conditions, only the repair specialist should change out the transceiver modules.

2-10.8 Installing Main Receiver-Transmitter.

Install the main receiver-transmitter as follows:

a. Ensure the appropriate transceiver module (30-88, 136-174, or 403-470 MHz) is installed in the receiver-transmitter. Refer to TO 31R2-2PRC139-1 for transceiver module replacement procedure.

b. Insert the receiver-transmitter for the main channel into the right sleeve of the base station unit. Make sure the side connector on the receiver-transmitter is facing up.

c. Turn the latching knob on the sleeve above the receiver-transmitter clockwise one-quarter turn until it locks.

2-10.9 Installing Guard Receiver-Transmitter.

Install the guard receiver-transmitter in the same manner as the main receiver-transmitter except insert the receiver-transmitter left sleeve of the base station unit.

2-10.10 Electrical Connections.

Cables required for installation are listed in Table 2-2. FO-1 illustrates the required cable connections. Make electrical connections as follows:

a. Connect the ground strap ring terminal, W6 (SS-3500279-501) to the GND post (3, Figure 4-4) on the right side panel of the base station unit and the other end to a known earth ground.

b. Connect the main antenna to MAIN connector J5 (2, Figure 4-4) on the right side panel of the base station unit using the coaxial antenna cable, W3 (SS-1600290-1).

c. Connect the guard antenna to GUARD connector J3 (5, Figure 4-4) on the right side panel of the base station unit using the coaxial antenna cable, W4 (SS-1600290-1).

d. Connect the base station power supply to POWER connector J2 (6, Figure 4-4) of the base station using the base station power cable, W2 (SS-3500274-501).

e. Connect base station power supply to power source using appropriate power input cable, W1 (SS-4500104-501, SS-4500105-501, or SS-4500106-501).

NOTE

The base station is supplied with three different power input cables as indicated in Table 2-2 to allow using power from alternative sources. The 120 and 220/240 VAC cables end in two or three prong plugs. The 10-32 VDC cable ends in two spade lugs that are attached to the positive and negative terminals of the base station primary battery tray (SS-4100954-501). Alternately, the DC power cable can be used to connect the base station power supply to one positive terminal and one negative terminal of two lead-acid batteries connected in series using jumper cable W7 (SS-2500116-501).

f. Connect the external loudspeaker to EXT SPKR connector J4 (4, Figure 4-4) on the base station using the cable which is part of the loudspeaker.

g. Connect an audio accessory, such as the dynamic microphone (SS-3100520-501) to the headset connector on the front of the base station unit by aligning the connector keyways, pressing down firmly, and rotating the cable connector clockwise.

h. (Optional) Connect programming cable assembly, W5 (SS-3500276-501) to the RS-232C connector, J1 (1, Figure 4-4) and secure using the flat blade screwdriver (R5323). This should be done only when the base station is to be used for external programming of a Radio Set, AN/PRC-139(C).

CHAPTER 3 PREPARATION FOR USE AND RESHIPMENT

3-1 INTRODUCTION.

This chapter is divided into two sections. Section I. Preparation For Use provides post-installation operational checks that must be performed prior to operating the base station. Section II. Preparation For Reshipment contains procedures for reshipment of the unit.

Section I. PREPARATION FOR USE

3-2 INSPECTION.

If the base station has not been inspected as part of the installation process, or if the equipment has not been used recently, check to ensure that all cable connections are tight and no damage is visible on the exterior of the base station.

3-3 POST-INSTALLATION CHECKOUT.

3-3.1 Preliminary.

Before performing the post-installation checkout procedures of paragraph 3-3.3 ensure that both receiver-transmitters have been loaded with the COMSEC keys, as described in TO 31R2-2PRC139-1, and are inserted in the sleeves and locked in place.

3-3.2 Alignment and Adjustment.

The base station is aligned and adjusted for normal operation at the factory/depot. No other alignments or adjustments are required or authorized.

3-3.3 Post-Installation Checkout Procedures.

3-3.3.1 Power-Up Check

Perform the power-up check as follows:

a. Place the base station POWER switch in the 5W position. Ensure that the PTT switch on the audio accessory is NOT depressed when power is applied.

b. Ensure that the GUARD, FAULT, and XMT LEDs and the 16-character display are initially illuminated in lamp test mode for approximately 2 seconds. Once the lamp test is successfully completed, the unit is ready for operation and the PTT switch can be used.

3-3.3.2 Operational Check.

Perform the operational checks included in paragraph 6-2 to verify that the major components of the base station are properly functioning.

3-3.3.3 Equipment Shutdown.

Shut down the base station as follows:

a. Place the base station POWER switch in the OFF position.

Section II. PREPARATION FOR RESHIPMENT

3-4 PREPARING UNIT FOR RESHIPMENT.

Prepare the base station for reshipment as follows:

a. Ensure that all COMSEC keys on each receiver-transmitter have been zeroized by turning the receiver-transmitter mode switch to Z (zeroize) (refer to TO 31R2-2PRC139-1 for more detail).

b. Disconnect all external accessories, antennas, and cables.

3-5 PACKING.

Pack the base station in the recommended packages illustrated in Figure 2-1. Use original packing materials if available. Table 2-1 identifies the contents of the nine shipping containers.

3-6 HANDLING AND STORAGE.

Place electronic assemblies in individual containers. This will prevent damage during handling and storage. If a common container is used, use suitable barrier material between electronic assemblies. Sufficient packing must be used to prevent shifting of electronic assemblies within the container. Package the equipment in accordance with MIL-STD-2073-1A/2B. Marking for reshipment and storage shall be in accordance with MIL-STD-129J.

CAUTION

Never apply pressure sensitive tape directly to connectors. This could damage connector pins.

3-6.1 Protective Measures for Electrical Connectors.

Protect all unmated connectors that are exposed to physical or environmental damage by covering with supplied protective caps.

3-6.2 Preparation for Shipment and Storage.

Before preparing the equipment for shipment or storage, ensure that the COMSEC keys on the receiver-transmitter have been zeroized (see paragraph 3-4a).

NOTE
CONTROLLED CRYPTOGRAPHIC ITEM

The receiver-transmitter is a CCI. Consult your custodian for security procedures applicable to the control and use of this receiver-transmitter.

CAUTION

Package all electrostatic discharge (ESD) sensitive assemblies in ESD bags before shipping or storing.

For shipment to another facility or long-term storage, package the unit as shown in Figure 2-1. Regardless of the electronic assembly design, fit all protruding parts with packing spacers, wrap the complete assembly with plastic or place in a plastic air-lock bag. Wrap with a protective cellulose, foam, or similar material. Wrap assemblies that contain electrostatic discharge (ESD) sensitive parts in static protective materials.

3-6.3 Handling.

Following are general handling instructions which should be followed when handling the equipment.

WARNING

Before performing removal/replacement procedures, make sure power is removed from the unit. Failure to do so could result in personal injury or damage to the equipment.

CAUTION

Rough handling can cause damage to electronic assemblies.

CAUTION

Electronic assemblies containing solid-state devices are susceptible to damage from static electrical discharges. Wear protective clothing and grounded wrist straps.

CAUTION

Forcing any misaligned electronic assembly into position may result in bent or broken pins.

CAUTION

Be very careful when removing or inserting an assembly into the equipment. If it is a plug-in CCA, be sure the guide pins are properly aligned before pressing the assembly in place. If the CCA tilts while being inserted, do not continue to press into position; straighten it, then apply even pressure to avoid tilting.

CAUTION

When repairing an electronic assembly, be careful that the tool employed does not inadvertently press against leads, pins, or other parts that are easily bent. Such pressure can destroy a good part and cause needless repair.

CAUTION

When handling an assembly that has been removed from its chassis, be careful not to press against the leads and pins. When removing an assembly, be sure to pull it straight out from the equipment. Do not cock, twist, pry, or jerk an electronic assembly to remove it from the mounting connector.

CAUTION

ELECTROSTATIC DISCHARGE

The base station contains components that are susceptible to damage by static electrical charges. Disassembly of the base station should only be done at a properly grounded work station.

CHAPTER 4 OPERATION

Section I. CONTROLS AND INDICATORS

4-1 INTRODUCTION.

This section describes and illustrates the indicators, controls, switches, keypad keys, and connectors required for operation of the base station.

4-2 CONTROLS AND INDICATORS.

The following paragraphs describe and illustrate all operational controls and indicators of the base station.

4-2.1 Indicators.

All indicators for the base station are illustrated in Figure 4-1 and described in Table 4-1.

4-2.2 Front Panel Controls, Switches, and Connectors.

All front panel controls, switches, and connectors are illustrated in Figure 4-2 and described in Table 4-2.

4-2.3 Keypad.

All keypad keys are illustrated in Figure 4-3 and described in Table 4-3.

4-2.4 Rear Panel Connectors.

All rear panel connectors used by the operator are illustrated in Figure 4-4 and described in Table 4-4.

4-2.5 Battery Tray Controls and Connectors.

The controls and connectors of the primary battery tray are illustrated in Figure 4-5 and described in Table 4-5.

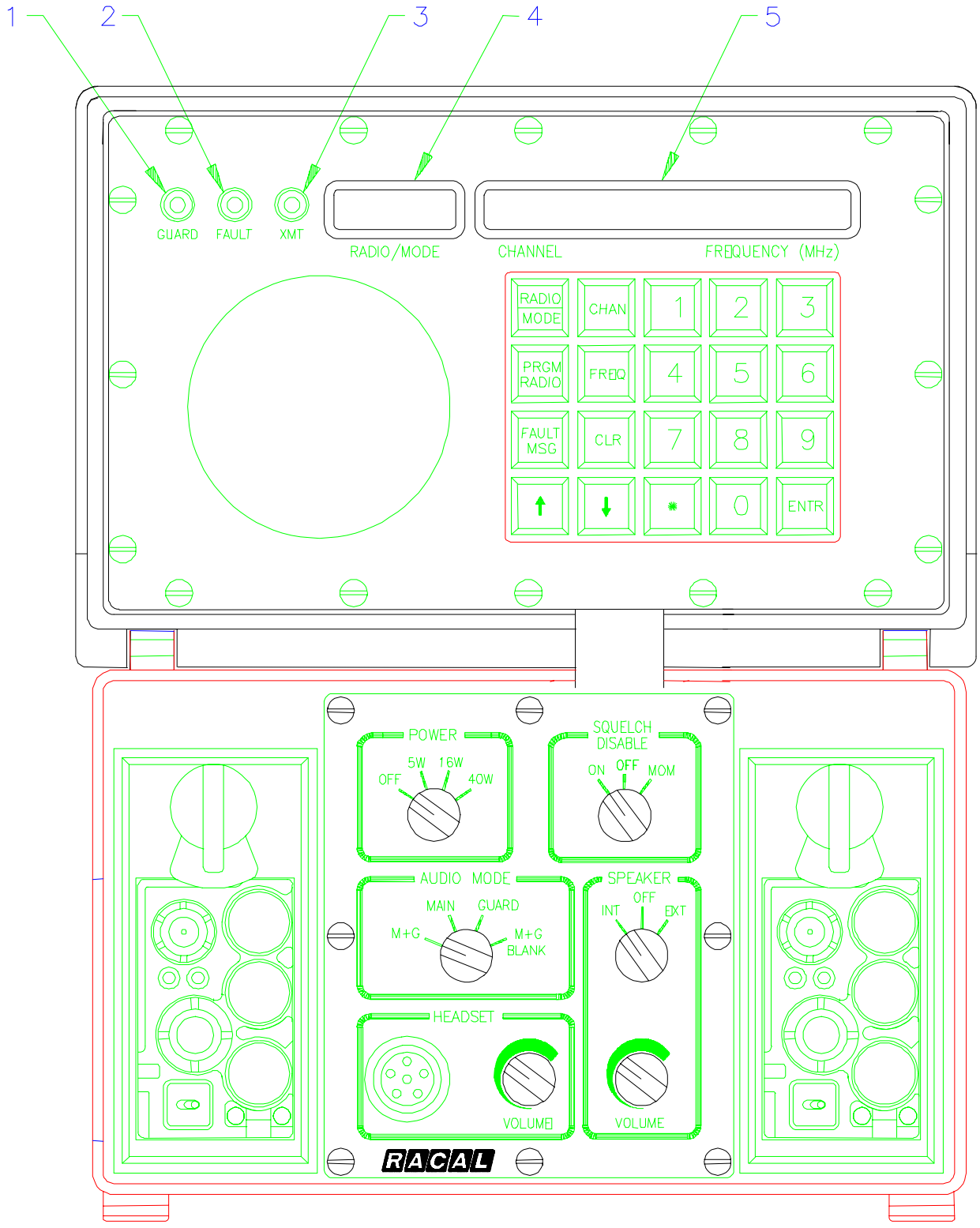


Figure 4-1. Location of Base Station Indicators

Table 4-1. Description of Operator Indicators

Fig & Index Number	Indicator	Function
4-1-1	GUARD light emitting diode (LED) (amber)	When illuminated, indicates the presence of receive traffic on the guard channel.
4-1-2	FAULT LED (red)	When illuminated, indicates a system fault. (Specific fault messages are described in Table 6-3.)
4-1-3	XMT (Transmit) LED (amber)	When illuminated, indicates that the unit is transmitting.
4-1-4	RADIO/MODE Display (4-character alpha-numeric display)	Identifies the current mode in which the base station is operating. Also used for programming menus. M/RX = Main receiver-transmitter in receive frequency M/TX = Main receiver-transmitter in transmit mode G/RX = Guard receiver-transmitter in receive frequency G/TX = Guard receiver-transmitter in transmit mode
4-1-5	CHANNEL/FREQUENCY (MHz) Display (12-character alpha-numeric display)	Displays the current channel and frequency on which the main or guard receiver-transmitter is operating. Displays a fault message or NO FAULTS when the FAULT MSG key is pressed. (Specific fault messages are described in Table 6-3.) Also used for programming menus.

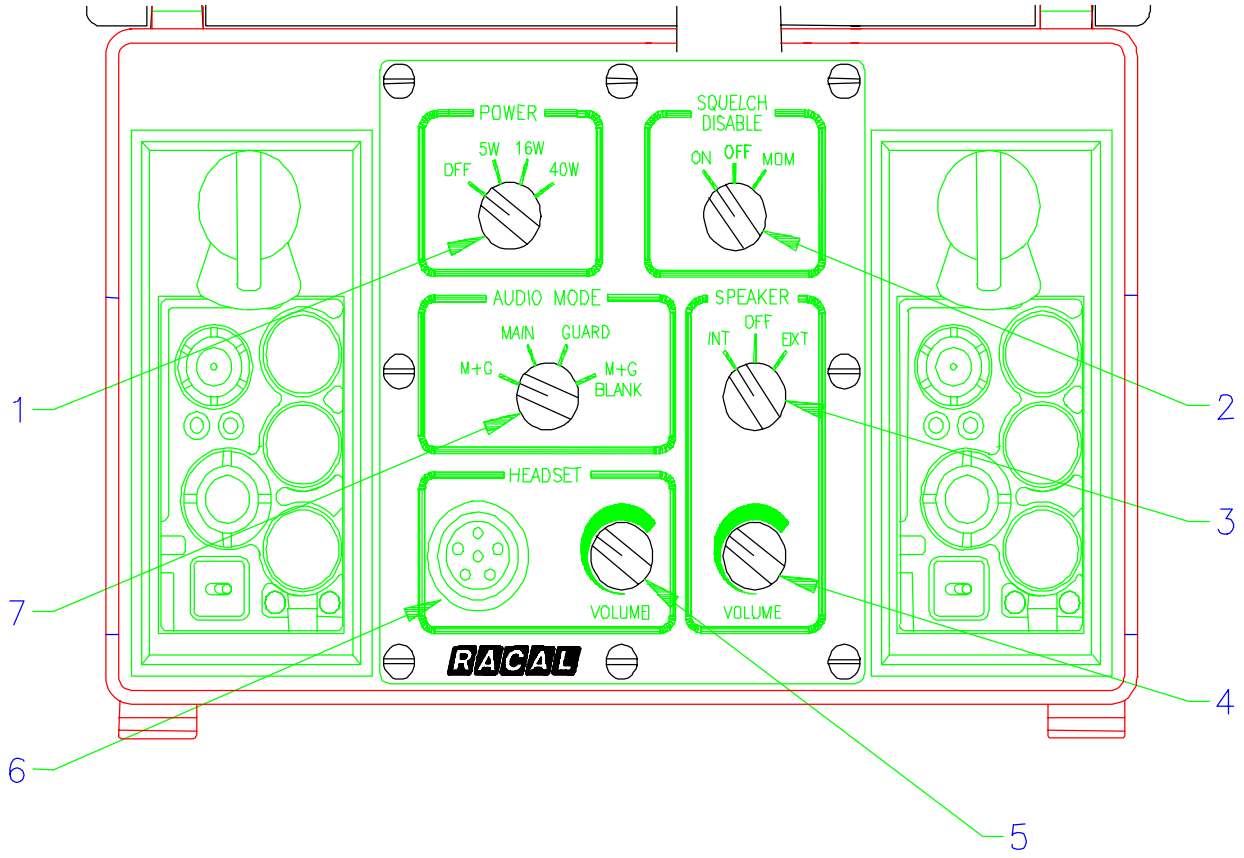


Figure 4-2. Location of Front Panel Controls, Switches and Connectors

Table 4-2. Description of Front Panel Operator Controls, Switches and Connectors

Fig & Index Number	Control/Switch	Function
4-2-1	POWER Switch (four-position rotary switch)	Allows selection of main channel RF transmit power of 5W, 16W, or 40W. OFF position turns off the base station.
4-2-2	SQUELCH DISABLE Switch (spring-loaded, three-position rotary switch)	Allows for opening and closing of squelch for the main and guard receiver-transmitters. OFF - Enables closed squelch. (Signal strength below a selected level is muted.) ON - Disables open squelch. MOM - Disables squelch (momentary action).
4-2-3	SPEAKER Switch (three-position rotary switch)	Allows selection of the speaker as either internal (INT), external (EXT), or none (OFF).
4-2-4	SPEAKER VOLUME Switch (eight positions)	Adjusts volume level of the internal or external speaker output to eight different levels.
4-2-5	HEADSET VOLUME Switch (eight positions)	Adjusts volume level of an optional headset to eight different levels.
4-2-6	HEADSET Connector	Allows for connection of an audio accessory. All audio accessories to be used with the base station should be connected to this connector, not to the receiver-transmitter audio connector.

Table 4-2. Description of Front Panel Operator Controls, Switches and Connectors - CONT

Fig & Index Number	Control/Switch	Function
4-2-7	AUDIO MODE Switch (four-position rotary switch)	Allows selection of base station audio source. M + G (Main + Guard) - Messages received on the guard channel will be combined with messages received on the main channel. MAIN - Only messages received on the main channel will be heard. Guard activity will be indicated by illumination of the front panel GUARD LED, and by emission of a beep tone from the speaker. GUARD - Only messages received on the guard channel will be heard. M + G (Main + Guard) BLANK - Messages on the guard channel are not heard during main channel transmission. The GUARD LED will not be illuminated by messages on the receive channel during main channel transmission. Both guard and main receive audio can be heard while the main channel is not transmitting. GUARD BLANK should be used when the main transmit frequency is close to the guard receive frequency (within 50 kHz) to prevent overload of the guard receive circuits.

Figure 4-3. Base Station Keypad

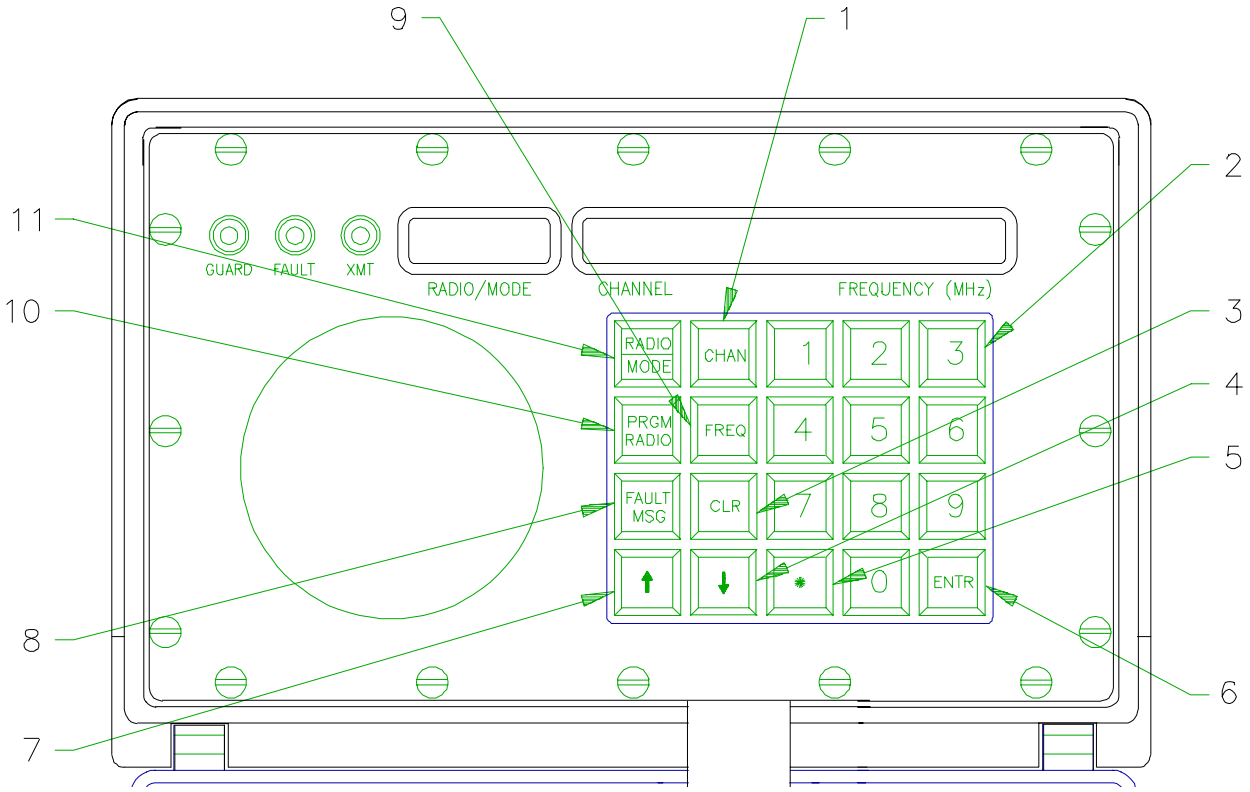


Table 4-3. Description of Keypad Keys

Fig & Index Number	Key	Function
4-3-1	CHAN (Channel) Key	Selects the channel entry mode.
4-3-2	Numeric Keys	Allows entering of receiver-transmitter frequencies and channel numbers.
4-3-3	CLR (Clear) Key	Deletes the right-most digit from the currently selected display field. Pressing the CLR key repeatedly deletes successive digits from the right end of the selected field.
4-3-4	Down Arrow (9) Key	Allows decrementing of channel numbers and manual frequencies, and decreases display intensity. Also used for scrolling menus and data in the program mode.
4-3-5	Decimal Point Key	Allows entry of a decimal point during input of operating frequencies.
4-3-6	ENTR (Enter) Key	Completes the entry of information during operation or programming of the receiver transmitter.
4-3-7	Up Arrow (8) Key	Allows incrementing of channel numbers and manual frequencies, and increases display intensity. Also used for scrolling menus and data in the program mode.
4-3-8	FAULT MSG (Message) Key	Allows the operator to display current active faults.
4-3-9	PRGM (Program) RADIO Key	Selects the receiver-transmitter programming mode.
4-3-10	FREQ (Frequency) Key	Selects the manual operating frequency mode.
4-3-11	RADIO/MODE Key	Allows for display of the channel number and TX/RX (transmit/receive) frequencies for the guard and main receiver-transmitters.

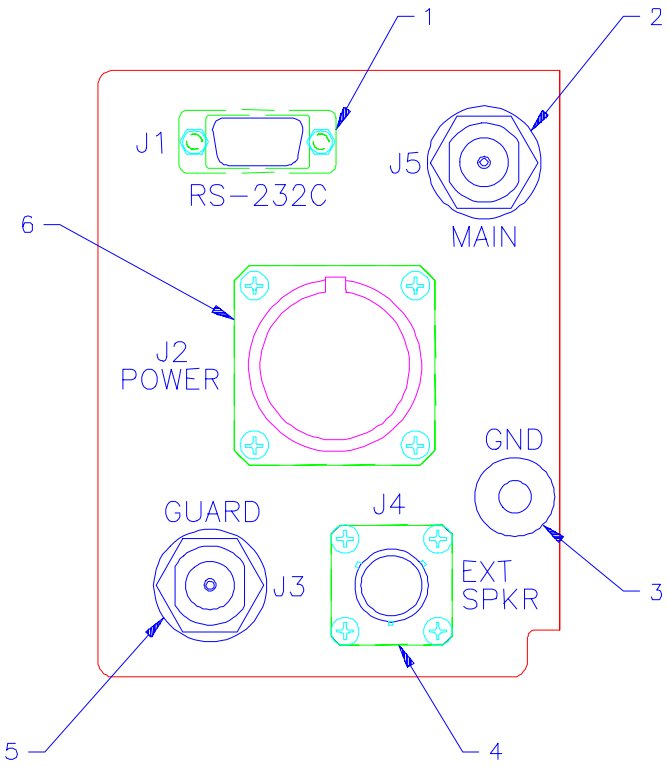


Figure 4-4. Location of Rear Panel Connectors

Table 4-4. Description of Rear Panel Connectors

Fig & Index Number	Connector	Function
4-4-1	RS-232C Connector J1	Connects an external receiver-transmitter for programming from the base station. Can also be used to provide power to a receiver-transmitter so that COMSEC key can be loaded from a KOI-18 or KYK-13. Refer to TO 31R2-2PRC139-1.
4-4-2	MAIN Antenna Connector J5	Connects main antenna to base station.
4-4-3	GND Connector	Provides connection for grounding the base station chassis to earth ground.
4-4-4	EXT SPKR (External Speaker) Connector J4	Connects external speaker to base station.
4-4-5	GUARD Antenna Connector J3	Connects guard antenna to base station.
4-4-6	POWER Connector J2	Connects external power source to base station.

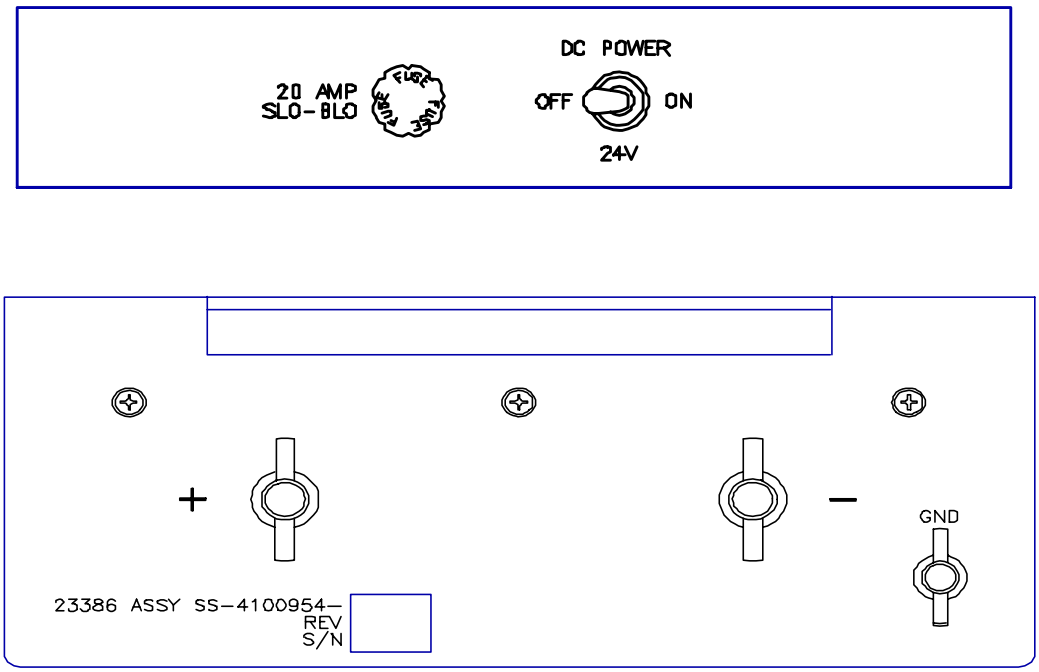


Figure 4-5. Battery Tray Switch and Connectors.

Table 4-5. Primary Battery Tray Switch and Connectors

Fig & Index Number	Connector	Function
4-5-1	20 Amp Fuse	Contains an in-line 20 amp fuse.
4-5-2	DC Power ON/OFF Switch	Turns battery power on and off.
4-5-3	Positive Connector	Connection point for positive lug of power cable SS-4500106-501.
4-5-4	Negative Connector	Connection point for negative lug of power cable SS-4500106-501.
4-5-5	GND Connector	Provides connection for grounding the base station chassis to earth ground.

Section II. OPERATING INSTRUCTIONS

4-3 MODES OF OPERATION.

There are five basic modes of operation for the base station. All are accessible via a single key depression on the operator panel keypad. In any mode, if no keys are pressed within the default time period (approximately 8 seconds), the base station will cancel all previous key entries and return to the last selected mode 0 (normal) display.

The five basic modes are:

Mode 0 = Normal operation [Default]

Mode 1 = Manual frequency entry [Press FREQ key]

Mode 2 = Channel entry [Press CHAN key]

Mode 3 = Display active faults [Press FAULT MSG key]

Mode 4 = Program receiver-transmitter [Press PRGM RADIO key]

4-4 INITIAL POWER-UP.

Perform the following procedure to power up the base station.

NOTE

If a hand-held radio is removed after the base station has been powered-up, turn the base station off, re-insert the hand-held radio, and re-initiate the power-up procedures.

NOTE

The main and guard receiver-transmitters may be different bandwidths (i.e., a 30-88 MHz main R/T may be used with a 403-470 MHz guard R/T) so long as the appropriate antennas are installed.

a. Ensure that main/guard receiver-transmitters having the appropriate transceiver modules (30-88, 136-174, or 403-470 MHz) have been installed in the base station and that no audio accessories are connected to the receiver-transmitters.

b. Ensure that the appropriate main/guard antennas (30-88, 136-174, or 403-470 MHz) have been installed.

c. Ensure that the base station power supply is connected to appropriate power source.

d. Ensure that the desired audio accessory is connected to the base station.

e. Ensure that all connections have been made in accordance with FO-1.

f. Use the POWER switch (1, Figure 4-2) to turn the base station on and to select the desired main channel RF transmit power. The available settings are 5W, 16W, and 40W. Ensure PTT switch on audio accessory is not pressed until the initial lamp test is complete (Seed paragraph 3-3.3.1).

g. Place the SPEAKER switch (3, Figure 4-2) in the INT position to enable the internal speaker or in the EXT position to enable the external speaker.

h. Place the SPEAKER VOLUME switch (4, Figure 4-2) in the center position.

i. Place the audio mode switch in the MAIN position.

NOTE

After steps a through i above have been successfully completed, the base station is in the normal operating mode and transmission and reception of receiver-transmitter traffic can begin, if the appropriate channels and frequencies have been programmed.

4-5 NORMAL OPERATION (MODE 0).

4-5.1 Introduction.

Mode 0, or the base station normal operation mode, displays the current frequency/channel status for the selected receiver-transmitter (main or guard) and receiver-transmitter mode (TX or RX). The mode 0 display options are:

M/RX = Displays main receiver-transmitter, main receive frequency

M/TX = Displays main receiver-transmitter, main transmit frequency

G/RX = Displays guard receiver-transmitter, guard receive frequency

G/TX = Displays guard receiver-transmitter, guard transmit frequency

The key/display sequence figures shown in paragraphs 4-5.2 through 4-5.3 indicate the display responses to a given key sequence from the initial display starting point shown below.

M / R X	8 7 7 . 9 0 0 0
Radio/Mode	**Channel** **Frequency(MHz)**

NOTE

The frequencies and other values shown on the displays above and in the remainder of this section are provided for illustration purposes only.

4-5.2 Select Radio (Receiver-Transmitter) and Mode.

Select either the M (main) or G (guard) receiver-transmitter and either TX (transmit) or RX (receive mode) as indicated in Table 4-6.

Table 4-6. Select Radio (Receiver-Transmitter) and Mode

Step	Procedure
1	Press the RADIO/MODE key (11, Figure 4-3) to display the M/TX mode. The screen will appear as follows: M / T X — 8 7 7 . 9 0 0 0 **Radio/Mode** **Channel** **Frequency(MHz)**
2	Press the RADIO/MODE key again to display the G/RX mode. The screen will appear as follows: G / R X — 3 8 8 . 0 0 0 0 **Radio/Mode** **Channel** **Frequency(MHz)**
3	Press the RADIO/MODE key again to display the G/TX mode. The screen will appear as follows: G / T X — 3 8 8 . 0 0 0 0 **Radio/Mode** **Channel** **Frequency(MHz)**
4	Press the RADIO/MODE key once again to return to the M/RX mode. The screen will appear as follows: M / R X — 8 7 7 . 9 0 0 0 **Radio/Mode** **Channel** **Frequency(MHz)**

NOTE
COMMUNICATIONS SECURITY

When using accessories (such as a boom microphone or hand-held PTT microphone), alarm audio and warning tones will not be heard during transmission. Cryptographic alarms will be heard after release of the PTT switch. Clear mode operation is indicated by a flashing amber LED on the receiver-transmitter.

4-5.3 Operation of Receiver-Transmitters.

Operate the main/guard receiver-transmitters as follows:

NOTE

The base station operating frequency range is either 30-88, 136-174, or 403-470 MHz, depending on the configuration of the receiver-transmitters inserted in the base station sleeves.

4-5.3.1 Introduction.

Before operating the receiver-transmitters as described in paragraphs 4-5.3.2 and 4-5.3.3, review the following:

a. Only certain transmit/receive frequencies are available, depending on whether the receiver-transmitters have an operating frequency range of 30-88, 136-174, or 403-470 MHz. For example, if 403-470 MHz receiver-transmitters are installed, the only frequencies that can be selected are in the 403-470 MHz frequency range. Any attempt to select frequency outside this range will result in a cleared display.

b. Before operating the receiver-transmitters for the first time, review the functions of all controls and indicators. Refer to TO 31R2-2PRC139-1.

c. Refer to paragraph 4-9.2.4 for receiver-transmitter channel and frequency zeroize procedure, if applicable.

NOTE
COMMUNICATIONS SECURITY

Ensure that the receiver-transmitter used in the base station is COMSEC zeroized (operating mode switch placed in Z position) before turning the receiver-transmitter into maintenance or storage. This will ensure that the keys installed in the receiver-transmitter are not compromised.

4-5.3.2 Transmitting Message.

The base station in mode 0 (normal operation) is capable of transmitting a message over either the main or guard frequency.

NOTE
COMMUNICATIONS SECURITY

When transmitting in the secure mode, wait approximately 0.5 second after depressing the PTT switch before beginning to speak. This allows time for the receiver-transmitter to initialize (transmit encryption preamble) before message transmission.

4-5.3.2.1 Main Channel Transmission.

Transmit messages over the main channel as follows:

a. Ensure the AUDIO MODE switch (7, Figure 4-2) is set to MAIN, M+G, or M+G BLANK.

b. If desired, enter the manual frequency (mode 1) and channel (mode 2) (see paragraphs 4-6 and 4-7, respectively) to change the frequency and/or channel on which transmission occurs.

c. Press the PTT on the appropriate audio accessory and talk into the microphone.

d. While transmitting, ensure that the amber XMT LED (3, Figure 4-1) lights.

4-5.3.2.2 Guard Channel Transmission.

The base station can also transmit messages over the guard channel at 2 watts RF power as follows:

a. Ensure the audio mode switch is set to GUARD.

b. If desired, enter the manual frequency (mode 1) and channel (mode 2) (see paragraphs 4-6 and 4-7, respectively) to change the frequency and/or channel on which transmission occurs.

c. Press the PTT on the appropriate audio accessory and talk into the microphone.

d. While transmitting, ensure that the amber XMT LED (3, Figure 4-1) lights.

4-5.3.3 Receiving Messages.

Whenever the base station is turned on, it is capable of receiving a message on the main or guard frequency. Received messages will be heard over the connected/selected audio accessories. The amber GUARD indicator (1, Figure 4-1) will be illuminated to indicate activity on the guard channel regardless of the position of the AUDIO MODE switch (7, Figure 4-2) (except for the M + G BLANK position).

4-5.3.3.1 Main Channel Reception.

Perform the following procedure to receive messages on the main frequency.

a. Place the AUDIO MODE switch (7, Figure 4-2) in the MAIN position.

b. Place the SPEAKER switch (3, Figure 4-2) in either the internal (INT), external (EXT), or OFF position as desired.

c. If speaker is selected, adjust the SPEAKER VOLUME switch (4, Figure 4-2) for desired volume of the received signal. Turn the switch clockwise to increase the volume or counterclockwise to decrease the volume.

d. If an audio accessory, such as the boom microphone, is selected, adjust the HEADSET VOLUME switch (5, Figure 4-2) for desired volume. Turn the switch clockwise to increase the volume or counterclockwise to decrease the volume.

e. Set the SQUELCH DISABLE switch (2, Figure 4-2) for desired squelch as follows:

OFF - Enables closed squelch.

ON - Disables open squelch.

MOM - Disables squelch momentarily.

4-5.3.3.2 Guard Channel Reception.

Perform the following procedure to receive messages on the guard channel:

a. Set the AUDIO MODE switch (7, Figure 4-2) as follows:

(1) In the M + G (Main + Guard) position to combine messages received on the guard channel with messages received on the main channel.

(2) In the GUARD position to hear messages only on the guard channel.

NOTE

If frequencies close to the main frequency band are used, use the M + G BLANK position to protect the guard receiver. Otherwise, the M + G position of the AUDIO MODE switch may be used.

(3) In the M + G BLANK position to blank reception on the guard channel during transmission on the main channel.

b. Place the SPEAKER switch (3, Figure 4-2) in either the internal (INT), external (EXT), or OFF position, as desired.

c. If SPEAKER switch is set to EXT, adjust the SPEAKER VOLUME switch (4, Figure 4-2) for desired volume of the received signal.

d. If SPEAKER switch is set to INT, adjust the HEADSET VOLUME switch (5, Figure 4-2) for desired volume of received signal.

e. Set the SQUELCH DISABLE switch (2, Figure 4-2) for desired squelch as follows:

OFF - Enables closed squelch.

ON - Disables open squelch.

MOM - Disables squelch momentarily.

f. Perform the manual frequency entry (mode 1) and channel entry (mode 2) procedures of paragraphs 4-6 and 4-7, respectively, if desired, to change the frequency and/or channel of the guard channel.

4-5.4 Display Intensity Adjustment.

In the base station normal mode of operation, the display brightness level can be changed to one of three different levels using the 8 or 9 keys on the operator panel keypad. The 8 key increases the display intensity and the 9 key decreases the display intensity. The display, GUARD, FAULT and XMT LEDs on the operator panel and the XMT LEDs on the main and guard receiver-transmitters will turn off for covert operation after pressing the 9 key at the display's lowest intensity level.

4-6 MANUAL FREQUENCY ENTRY (MODE 1).

Perform the procedure in Table 4-7, if required, to change the main receive (M/RX) frequency, main transmit (M/TX) frequency, guard receive (G/RX) frequency, or guard transmit (G/TX) frequency.

Table 4-7. Manual Frequency Entry (Mode 1)

Step	Procedure
1	Press the RADIO/MODE key (11, Figure 4-3) until the RADIO/MODE display (4, Figure 4-1) displays M/RX, M/TX, G/RX, or G/TX, as applicable.
2	Press the FREQ key (10, Figure 4-3). The flashing cursor will appear to the far right of the CHANNEL/ FREQUENCY (MHz) display. The display will appear as follows: M / R X — **Radio/Mode**; [ ] — **Channel**; **Frequency(MHz)**
3	Using the numeric keys (2, Figure 4-3) and decimal point key (5, Figure 4-3), on the base station keypad, enter the desired main receiver-transmitter receive frequency. Observe that the displayed digits shift to the left, starting at the cursor. The maximum number of digits that can be entered in the frequency entry mode is eight including a decimal point.
4	After the frequency has been entered, press the ENTR key (6, Figure 4-3) to enter the selected frequency into the receiver-transmitter. Entering 45.025 for the main receive frequency, for example, updates the display to the following: M / R X — **Radio/Mode**; 0 — **Channel**; 4 5 . 0 2 5 0 — **Frequency(MHz)**

Table 4-7. Manual Frequency Entry (Mode 1) - CONT

Step	Procedure
5	If a frequency is entered that is out of range, the CHANNEL/FREQUENCY (MHz) display (5, Figure 4-1) automatically clears, leaving a flashing cursor, after pressing the ENTR key. If this occurs, verify that the selected frequency is consistent with the installed receiver-transmitter, and re-enter the frequency.
6	Ensure that a 0 is displayed in the CHANNEL field of the CHANNEL/FREQUENCY (MHz) display. This indicates manual frequency operation.
7	If any erroneous digits are entered into the display, press the CLR key (3, Figure 4-3) repeatedly to delete successive digits from the right until the erroneous digit has been removed.
8	Alternatively, press the FREQ key again to enter a new frequency.
9	Alternatively, first press the FREQ key. Then press the up arrow key (8) (7, Figure 4-3) or the down arrow key (9) (4, Figure 4-3) to increment or decrement the frequency in channel 0 in 12.5-kHz steps.

NOTE

When entering a new RX frequency manually, the TX frequency defaults to the same frequency. The TX frequency may be changed independently by selecting the TX frequency mode using the RADIO/MODE key.

4-7 CHANNEL ENTRY (MODE 2).

Perform the procedure in Table 4-8, if required, to change the main channel, or guard channel.

Table 4-8. Channel Entry (Mode 2)

Step	Procedure
1	Press the RADIO/MODE key (11, Figure 4-3) until the RADIO/MODE display (4, Figure 4-1) displays M/RX, M/TX, G/RX, or G/TX, as desired.
2	Press the CHAN key (1, Figure 4-3). The flashing cursor will appear to the far right of the CHANNEL display. In the channel entry mode, only a two-digit entry is allowed. A typical display will be as follows: M / R X **Radio/Mode** **Channel** **Frequency(MHz)**
3	Using the numeric keys (2, Figure 4-3) on the base station keypad, enter the desired channel number from 0 to 14.
4	After the channel has been entered, press the ENTR key (6, Figure 4-3) to enter the selected channel into the receiver-transmitter.

Table 4-7. Channel Entry (Mode 2) - CONT

Step	Procedure
5	If a channel is entered that is out of range, the CHANNEL display clears. If this occurs, re-enter the channel. Entering channel 14, for example, updates the display as follows: M / R X — 1 4 8 2 . 4 6 2 5 **Radio/Mode** **Channel** **Frequency(MHz)**
6	If any erroneous digits are entered into the display, press the CLR key (3, Figure 4-3) repeatedly to delete digits from the right until the erroneous digit has been removed.
7	Alternatively, press the CHAN key (1, Figure 4-3) again to enter a new channel.
8	Alternatively, first press the CHAN key. Then press the up arrow key (8) (7, Figure 4-3) or down arrow key (9) (4, Figure 4-3) to increment or decrement the currently displayed channel number.

4-8 DISPLAYING ACTIVE FAULTS (MODE 3).

If the FAULT LED (2, Figure 4-1) is illuminated, indicating a system fault, display the current active faults as indicated in Table 4-9.

Table 4-9. Displaying Active Faults (Mode 3)

Step	Procedure
1	Press the FAULT MSG key (8, Figure 4-3). If there are no base station faults when this key is pressed, the display will indicate NO FAULTS. The display will appear as follows: [ ] — N O F A U L T S **Radio/Mode** **Channel** **Frequency(MHz)**
2	If there is a fault, the CHANNEL/FREQUENCY (MHz) display will display the first fault found. Use the arrow keys to scroll through the fault list if there is more than one fault. The fault list will always roll over from the last fault in the list back to the first fault. A table of all fault messages and their meanings is contained in Table 6-3. A sample fault message indicating that the guard receiver-transmitter is not installed is shown below: F L T > — N O G U A R D R A D **Radio/Mode** **Channel** **Frequency(MHz)**

4-9 PROGRAMMING RADIO (MODE 4).

This mode of operation provides the operator with another method of verifying and changing the receiver-transmitter parameters. (The other method would be to use the Frequency Fill Device.)

The program radio (Receiver-Transmitter) mode is selected by pressing the PRGM/RADIO key (9, Figure 4-3). The frequency and channel portion of the CHANNEL/FREQUENCY (MHz) display (5, Figure 4-1) is then used to prompt the operator through the programming operations. The arrow keys can then be used to page through the first level of operator prompts. To select an operation, press the ENTR key (6, Figure 4-3) at the desired prompt. In most cases, the arrow keys can be used to page through the available selections/operations.

As entries are made, the selected receiver-transmitter parameters are changed within the connected receiver-transmitter. If an error is discovered in the entered data, all the operator has to do is re-enter the data. Within the receiver-transmitter, only those data fields which have been manually entered will be changed. All other receiver-transmitter data will remain unchanged.

4-9.1 Description of Program Radio (Receiver-Transmitter) Mode.

4-9.1.1 Receiver-Transmitter Global Operations.

There are some parameters that affect all receiver-transmitter channels equally. For example, the transmit (TX) timeout parameter is the same for all channels. These parameters are referred to as global parameters.

Example: If the TX timeout is set to 30 seconds, then all channels will have a 30 second transmit timeout.

Receiver-transmitter global parameters are the squelch level, TX timeout, and clone control. Refer to Table 4-10.

4-9.1.2 Receiver-Transmitter Channel Operations.

All of the receiver-transmitter programmable parameters that are not global are considered to be channel parameters. In other words, channel 1 parameters may be programmed independently from those in channel 2 and so on. For example, the channel 1 TX frequency may be set to 136.0125 MHz, while the channel 2 TX frequency may be set to 172.0250 MHz. Channel parameters are the RX frequency, TX frequency, RX Continuous-Tone Controlled Squelch System (CTCSS) tone, TX CTCSS tone, RF transmit power, and RX IF bandwidth and secure data rate (12/16 kbps). Refer to Table 4-10.

The selected channel may be changed at any time by simply pressing the CHAN key (1, Figure 4-3). The channel display blanks the current channel and displays a flashing cursor. The data keys can then be used to key in the desired channel followed by the ENTR key (6, Figure 4-3). Alternatively, after the CHAN key has been pressed, the arrow keys can be used to ramp up or down from the current channel and the new channel selected by pressing the ENTR key.

Programmable Function		Parameter Classification			Zeroized Default Values
Function	Parameters	Global	Channel	Execute	
! Carrier Squelch Level	6, 8, 10, 12, 14, 16 dB	X			8 dB
! TX Timeout	30, 60, 90, 120, INF (Infinite) seconds	X			INF
! Clone Control	Master, Slave, Disabled, No Change	X			Disabled
! Zeroize Receiver-Transmitter	Initiate erasure of all receiver-transmitter programmed data.			X	--
! RX Frequency	! 30-88 MHz (inclusive) in 12.5 kHz steps ! 136-174 MHz (inclusive) in 12.5 kHz steps ! 403-470 MHz (inclusive) in 12.5 kHz steps		X		0 MHz
! TX Frequency	(same as RX Frequency above)		X		0 MHz
! RX CTCSS Tone	100.0, 103.5, 107.2, 110.9, 114.8, 118.8, 123.0, 127.3, 131.8, 136.5, 141.3, 146.2, 151.4, 156.7, 162.2, 167.9, NONE and 150 Hz for 30-88 MHz band receiver-transmitters only		X		NONE
! TX CTCSS Tone	(same as RX CTCSS Tone above)		X		NONE
! RF Transmit Power	0.5, 2 watts		X		2.0 W
! RX IF Bandwidth	12.5, 25.0 kHz for 136-174 MHz and 403-470 MHz band receiver-transmitters only.		X		25 kHz
! Secure Data Rate	12, 16 kbps		X		16 kbps

Table 4-10. Base Station Programming Requirements Matrix

4-9.1.3 Programmable Features.

Table 4-11 defines programmable features of the base station.

Table 4-11. Programmable Features

Programmable Feature	Parameter Limits	Function and Purpose
Carrier Squelch Level	6, 8, 10, 12, 14, 16 dB	This feature is used to determine the received signal strength that will "break squelch" (the radio recognizes that traffic is being received). The higher values (16, 14, etc.) should be used in high traffic density areas and where the desired traffic is being broadcast only over short ranges (one mile or less). The lower values (6, 8, etc.) should be used where there is limited radio traffic and the desired traffic is being broadcast at the limits of effective range.
Transmit (TX) Timeout	30, 60, 90, 120, seconds and INF (No limit)	This feature automatically ends transmission after a fixed period of time. The purpose is to prevent inadvertent or prolonged operation in transmit mode that can significantly shorten battery charge life.
Clone Control	Master, Slave, No Change, and Disabled	This feature determines the cloning capability of the handheld radio. ! Master: can clone other radios as master radios, which can in turn clone other radios as master radios in an indefinite chain; ! Slave: can clone other radios as clone disabled radios; ! No Change: can clone all programmable information into another radio without changing the initial cloning state of the target radio (i.e., does not transfer cloning data - master remains master, slave remains slave); ! Disabled: cannot clone another radio.
Zeroize Receiver-Transmitter		This feature deletes all user-programmable information from the radio except COMSEC keys.
Receive (RX) Frequency	! 30-88 MHz (inclusive in 12.5 kHz steps ! 136-174 MHz (inclusive) in 12.5 kHz steps ! 403-470 MHz (inclusive) in 12.5 kHz steps	This feature is used to set the receive frequency for each of the 14 radio channels. The frequency for each channel must be programmed separately. Frequency tuning steps (minimum separation of two channels) are 12.5 kHz. The frequencies set shall be those allocated by the activity Frequency Allocation Manager.

Table 4-11. Programmable Features - CONT

Programmable Feature	Parameter Limits	Function and Purpose
TX Frequency	! 30-88 MHz (inclusive in 12.5 kHz steps ! 136-174 MHz (inclusive) in 12.5 kHz steps ! 403-470 MHz (inclusive) in 12.5 kHz steps	This feature is used to set the transmit frequency for each of the 14 radio channels. When a channel receive frequency is set, the transmit frequency for that channel is automatically set to the same frequency. However, the transmit frequency may be programmed separately to a different value. Frequency tuning steps (minimum separation of two channels) are 12.5 kHz. The frequencies set shall be those allocated by the activity Frequency Allocation Manager.
RX Continuous Tone Controlled Squelch System (CTCSS) Tone	100.0, 103.5, 107.2, 110.9, 114.8, 118.8, 123.0, 127.3, 131.8, 136.5, 141. 3, 146.2, 151.4, 156.7, 162.2, 167.9 Hz, and NONE 150.0 Hz for 30-88 MHz transceiver module only	This feature allows the radio to be programmed to receive only selected radio traffic, i.e., only traffic with the selected CTCSS tone. A different tone, or no tone, can be programmed for each channel.
TX CTCSS Tone	Same as RX CTCSS Tone	This feature allows the radio to be programmed to transmit a specific CTCSS tone, which will be received only by other radios programmed to receive traffic with that tone. The TX tone for a specific channel is automatically set when the RX tone for that channel is programmed. A different tone, or no tone, can be separately programmed for each channel.
Radio Frequency (RF) Transmit Power	0.5 or 2.0 watts	This feature allows the selection of two levels of transmit power. The lower level conserves battery life and limits transmission range. The higher level will increase the transmission range, but limits battery life.
RX Intermediate Frequency (IF) Bandwidth	12.5 or 25.0 kHz for 136-174 and 403-470 transceiver modules only	This feature determines the bandwidth of the RF radio signal. The bandwidth is normally set by the Frequency Allocation Manager. The radio must be set to 25 kHz IF bandwidth for secure operation and must be set to 12.5 kHz IF bandwidth for compatibility with 12.5 kHz commercial radios.
Secure Data Rate	12 or 16 kbps	This feature allows the selection of two different data rates for secure operation and determines the interoperability of the radio. 12 kbps shall be selected for FED-STD-1023 compatible operation (most commercial secure radios) and 16 kbps shall be selected for VINSON compatible operation.

NOTE

For interoperability with the AN/PRC-77, the RX CTCSS tone must be set to NONE and the TX CTCSS Tone must be set to 150.0 Hz.

4-9.1.4 Menu Operations.

The following paragraphs describe the menu operations initiated through the base station operator panel, including the purpose of the various menu types and movement from menu to menu. Because there are a large number of possible data entry combinations, only a basic example of each menu group is provided. It is assumed that the user is already knowledgeable on operation and programming requirements for the receiver-transmitter. (Refer to TO 31R2-2PRC139-1.)

4-9.1.4.1 Movement Between Menus.

The up arrow (8) key (7, Figure 4-3) will scroll up from the current menu or option and the down arrow (9) key (4, Figure 4-3) will scroll down from the current menu or option. The arrow keys will not scroll if there is only one selection available. All menus are circular; that is, they will always roll-over from end to beginning from a scroll-up or scroll-down operation. There are no write operations to the receiver-transmitter during scroll operations. However, if the current menu field happens to be receiver-transmitter data, then on each scroll operation, the base station reads the receiver-transmitter in order to display the currently programmed data. A menu may consist of any combination of operations, options or menu selections. However, during scrolling, the base station queries the receiver-transmitter on the displayed parametric, and displays the value currently programmed in the receiver-transmitter. For example, if transmit frequency for channel 1 is selected on the base station, the display will contain the channel 1 transmit frequency currently programmed in the receiver-transmitter. If channel 2 is then selected, the base station will check the channel 2 transmit frequency programmed in the receiver-transmitter and display that value. If no value is programmed, the display will read TX FREQ=. Figure 4-5 is a simplified diagram showing available menus.

4-9.1.4.2 Movement Into and Out of Menus.

The ENTR key (6, Figure 4-3) is used to advance into the menu structure, select menu options and enter data keyed in with the data keys. The CLR key (3, Figure 4-3) is used to back out of the menu structure, to deselect an operation within a menu or to delete non-valid entries keyed in with the data entry keys.

4-9.1.4.3 Data Entry Operations.

When the menu selection is a data entry operation, the first press of the ENTR key will activate the data entry window. The existing data and = sign will disappear and a > sign will appear in the display indicating that new data must be keyed in with the digit keys. The new data must be selected by using the up arrow (8) and down arrow (9) keys (7, 4, Figure 4-3). The new data must be entered with an additional press of the ENTR key (6, Figure 4-3). The display will remain in the current menu selection with the new data and = sign displayed for verification and the data entry window disabled.

4-9.1.4.4 Channel and Frequency Data Entries.

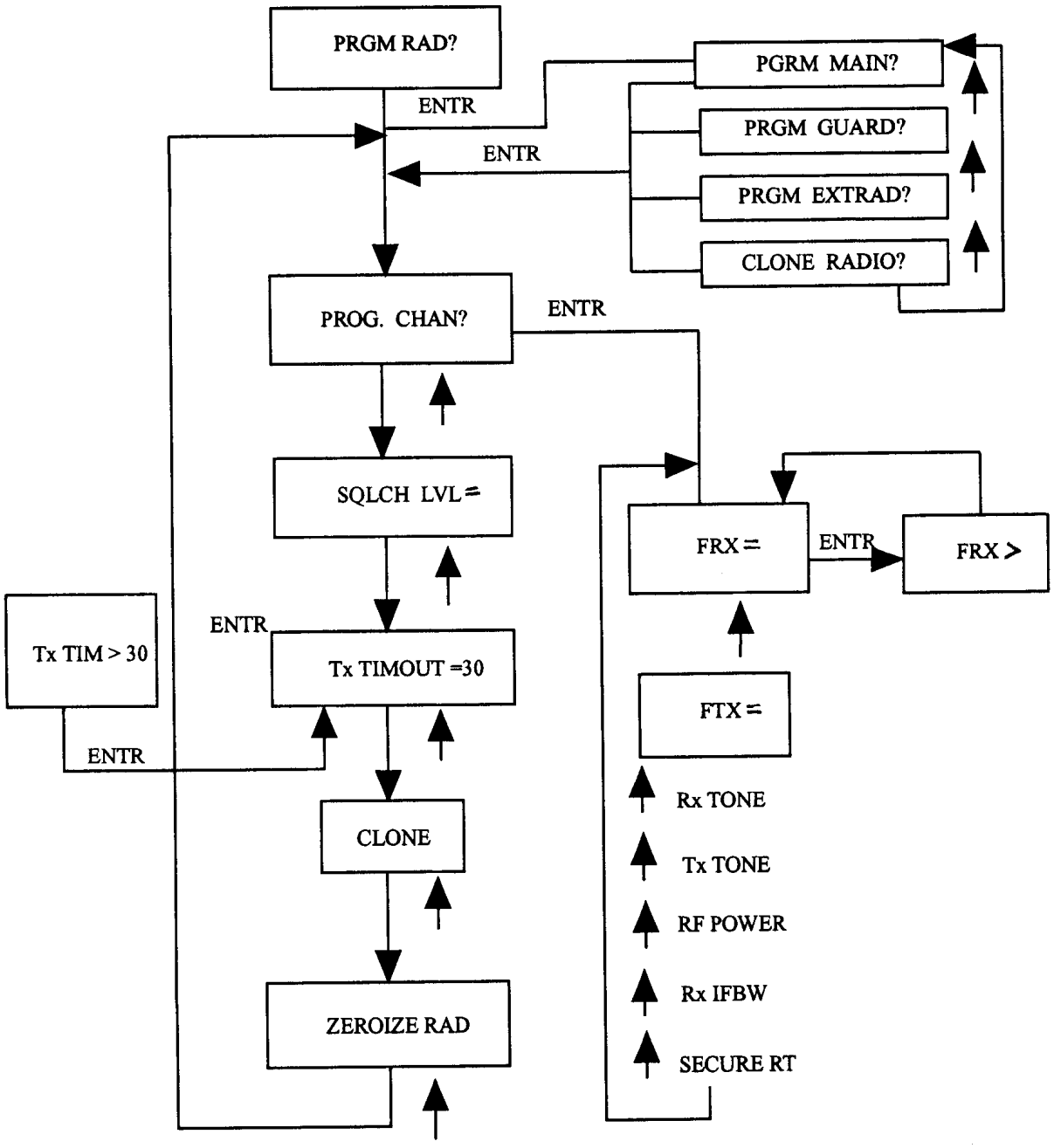
With frequency and channel entries, if an erroneous value has been keyed in and the ENTR key (6, Figure 4-3) pressed, the display returns to the start of the frequency or channel entry mode re-blinking the right-most display field character. If erroneous digits are entered into the display field, the CLR key (3, Figure 4-3) can be pressed repeatedly to delete successive digits from the right until the erroneous digit has been removed. The maximum number of characters that can be entered is eight, including a decimal point in the frequency mode and two in the channel mode. No decimal point entries are accepted in the channel mode. The CHAN key (1, Figure 4-3) is used to invoke the channel entry mode and valid channel entries are from channel 0 through channel 14. In both frequency and channel modes the ENTR key must be pressed to download the new data into the receiver-transmitter. Channels may be changed at any time during a programming sequence.

4-9.1.4.5 Zeroizing the Receiver-Transmitter (Frequency Clearing).

The transmit and receive frequency information loaded into a receiver-transmitter may be zeroized using the base station. The zeroize function simply programs the receiver-transmitter TX and RX frequencies to zero for all channels and programs factory default value for the remaining parameters. Refer to Table 4-10 for the zeroized default value for each parameter.

NOTE

The COMSEC keys must be zeroized using the receiver-transmitter operating mode switch. Refer to TO 31R2-2PRC139-1.



GLOBAL 6 Center column accessed via UP/DOWN arrows.

CHANNEL SPECIFIC 6 ENTR from PROGRAM CHANNEL? to RX FREQ=

UP/DOWN arrows to access other channel parameters

Hit CLR at any of the channel specific menus to return to PROGRAM CHANNEL? screen.

Hit CLR at any of the global menus to return to PROGRAM RADIO? screen.

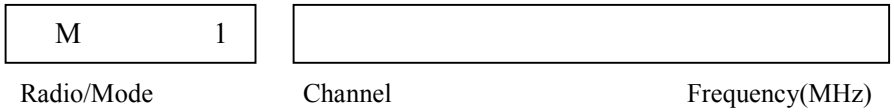
Figure 4-6. Available Menus

4-9.2 Detailed Programming Instructions.

4-9.2.1 General.

This section provides detailed procedures required to program a receiver-transmitter using the base station. The following paragraphs have been written for an operating range of 136-174 MHz. The general operation of the program mode is the same when programming a 30-88 MHz or 403-470 MHz receiver-transmitter. These instructions assume that the base station is powered-up and that the main and guard receiver-transmitters are in place.

The basic programming mode screen is shown below, providing pertinent information as to what each of the data fields and characters means.



M = Main Receiver-Transmitter — Menu and Data Field
G = Guard Receiver-Transmitter
E = External Receiver-Transmitter

Assume that the main receiver-transmitter is already programmed with the following channel 1 and global data.

RECEIVER-TRANSMITTER'S CURRENT PROGRAMMED DATA

CHANNEL	RX FREQ	TX FREQ	RX TONE	TX TONE	RF POWER	IF BW	SECURE RATE
1	136.0250	168.5000	167.9	114.8	2.0	25	16

GLOBAL DATA

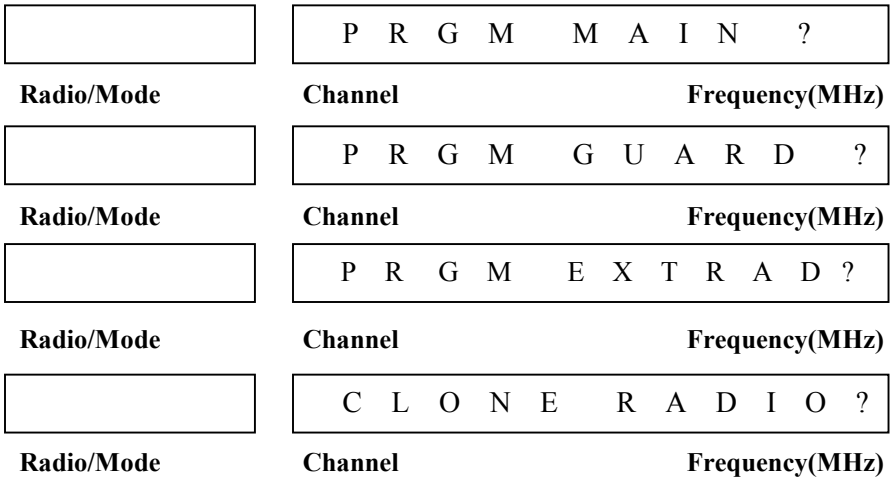
Squelch Level = 12 dB
TX Timeout = 30 Seconds
Clone Control = SLAVE

Paragraph 4-9.2.2 details the procedures required to reprogram the main receiver-transmitter with the following information:

Menu	New Data	Parameter Type
Squelch Level	14 dB	Global
TX Timeout	90 Seconds	Global
Clone Control	Master	Global
RX Frequency	168.5000 MHz	for Channel 1
TX Frequency	154.6125 MHz	for Channel 1
RX CTCSS Tone	114.8 Hertz (Hz)	for Channel 1
TX CTCSS Tone	NONE	for Channel 1
RF Transmit Power	0.5 watt	for Channel 1
RX IF Bandwidth	12.5 kHz	for Channel 1
Secure Rate	12 kbps	for Channel 1

To program the receiver-transmitter, press the PRGM RADIO key (9, Figure 4-3). The screen will appear as follows:

If you press ENTR (6, Figure 4-3) at the PRGM RADIO? prompt, the next screen selection will allow you to program the main, guard, or external receiver-transmitters or to clone a receiver-transmitter. By scrolling through the options, using the up arrow (8) key (7, Figure 4-3) or down arrow (9) key (4, Figure 4-3) the various screens will appear as follows:



For this manual, assume that it is the main receiver-transmitter that you are programming. Press ENTR at the PRGM MAIN? prompt.

The following paragraphs depict the sequence that should be followed for programming the main receiver-transmitter.

4-9.2.2 Program Channel.

Program channel as indicated in Table 4-12.

Table 4-12. Program Channel

Step	Procedure
1	At the PRGM MAIN? prompt, press the ENTR key (6, Figure 4-3). The display will look as follows: P R G M C H A N ? **Radio/Mode** **Channel** **Frequency(MHz)**
2	If the ENTR key is pressed at the PRGM CHAN? prompt, the following menus may be selected by pressing the arrow keys: RX FREQUENCY, TX FREQUENCY, RX TONE, TX TONE, RF POWER, RX IF bandwidth, and secure data rate.
3	Using the CHAN key (1, Figure 4-3), select channel 1 for programming.

4-9.2.2.1 RX Frequency.

Change RX frequency as indicated in Table 4-13.

Table 4-13. RX Frequency

Step	Procedure
1	The RX frequency menu will appear as follows after pressing the ENTR key (6, Figure 4-3) at the PRGM CHAN? prompt and selecting channel 1. M 1 | F R X = 1 3 6 . 0 2 5 0 **Radio/Mode** **Channel** **Frequency(MHz)**
2	If the RX frequency is correct, press the up arrow (8) key (7, Figure 4-3) to proceed to the next option.
3	If the RX frequency needs to be changed, press the ENTR key (6, Figure 4-3) at this point. The data entry screen will appear as follows: M 1 | F R X > **Radio/Mode** **Channel** **Frequency(MHz)** NOTE The = sign has been replaced with the > sign, indicating the edit mode.
4	To change the RX frequency to 168.5 MHz, enter the new frequency using the numeric keys (2, Figure 4-3) and decimal point key (5, Figure 4-3), then press the ENTR key (6, Figure 4-3). The screen will now look like this: M 1 | F R X = 1 6 8 . 5 0 0 0 **Radio/Mode** **Channel** **Frequency(MHz)**
5	The display will remain in the current menu selection with the new data and the = displayed for verification. NOTE The base station automatically programs the TX frequency to the new RX frequency as well.

4-9.2.2.2 TX Frequency.

Change TX frequency as indicated in Table 4-14.

Table 4-14. TX Frequency

Step	Procedure
1	After pressing the up arrow (8) key (7, Figure 4-3), the TX frequency menu will appear as follows: M 1 — F T X = 1 6 8 . 5 0 0 0 **Radio/Mode** **Channel** **Frequency(MHz)**
2	If the TX frequency is correct, press the up arrow (8) key (7, Figure 4-3) to proceed to the next option.
3	If the TX frequency needs to be changed, press the ENTR key (6, Figure 4-3) at this point. The data entry screen will appear as follows: M 1 — F T X >* **Radio/Mode** **Channel** **Frequency(MHz)** NOTE The = sign has been replaced with the > sign, indicating the edit mode.
4	To change the TX frequency to 154.6125 MHz, enter the new frequency using the numeric keys (2, Figure 4-3) and decimal point key (5, Figure 4-3), then press the ENTR key. The screen will now look like this: M 1 — F T X = 1 5 4 . 6 1 2 5 **Radio/Mode** **Channel** **Frequency(MHz)**
5	The display will remain in the current menu selection with the new data and the = displayed for verification. NOTE The base station only programs the TX frequency to the new transmit frequency, the RX frequency is unchanged.

4-9.2.2.3 RX Tone.

Change RX tone as indicated in Table 4-15.

Table 4-15. RX Tone

Step	Procedure
1	After pressing the up arrow (8) key (7, Figure 4-3), the RX tone menu will appear as follows: M 1 — R X T O N E = 1 6 7 . 9 **Radio/Mode** **Channel** **Frequency(MHz)**
2	If the RX tone is correct, press the up arrow (8) key (7, Figure 4-3) to proceed to the next option.
3	If the RX tone needs to be changed, press the ENTR key (6, Figure 4-3) at this point. The data entry screen will appear as follows: M 1 — R X T O N E > 1 6 7 . 9 **Radio/Mode** **Channel** **Frequency(MHz)** NOTE The = sign has been replaced with the > sign indicating the data entry mode.
4	To change the RX tone to 114.8, scroll through the values until 114.8 is displayed and then press ENTR (6, Figure 4-3). The menu screen will look like this: M 1 — R X T O N E = 1 1 4 . 8 **Radio/Mode** **Channel** **Frequency(MHz)**
5	The display will remain in the current menu selection with the new data and the = displayed for verification. NOTE The base station automatically programs the TX CTCSS tone to the new RX CTCSS tone as well.

4-9.2.2.4 TX Tone.

Change TX tone as indicated in Table 4-16.

Table 4-16. TX Tone

Step	Procedure
1	After depressing the up arrow (□) key (7, Figure 4-3), the TX tone menu will appear as follows: M 1 — T X T O N E = 1 1 4 . 8 **Radio/Mode** **Channel** **Frequency(MHz)**
2	If the TX tone is correct, press the up arrow (□) key (7, Figure 4-3) to proceed to the next option.
3	If the TX tone needs to be changed, press the ENTR key (6, Figure 4-3) at this point. The data entry screen will appear as follows: M 1 — T X T O N E > 1 1 4 . 8 **Radio/Mode** **Channel** **Frequency(MHz)** NOTE The = sign has been replaced with the > sign indicating the data entry mode.
4	To change the TX tone to NONE, scroll through the values using the arrow keys until NONE is displayed and then press ENTR (6, Figure 4-3). The menu screen will look like this: M 1 — T X T O N E = N O N E **Radio/Mode** **Channel** **Frequency(MHz)**
5	The display will remain in the current menu selection with the new data and the = displayed for verification. NOTE The base station only programs the TX CTCSS tone. The RX CTCSS tone is unchanged.

4-9.2.2.5 RF Power.

Change RF power as indicated in Table 4-17.

NOTE

When a receiver-transmitter is inserted in the base station, the RF power is automatically set to 0.5W. The RF power setting programmed here only affects the operation of a receiver-transmitter that is not installed in a base station.

Table 4-17. RF Power

Step	Procedure
1	After depressing the up arrow (□) key (7, Figure 4-3), the power menu will appear as follows: M 1 — R F P O W E R = 2 . 0 **Radio/Mode** **Channel** **Frequency(MHz)**
2	If the RF power level is correct, press the up arrow (□) key (7, Figure 4-3) to proceed to the next option.
3	If the RF power level needs to be changed, press the ENTR key (6, Figure 4-3) at this point. The data entry screen will appear as follows: M 1 — R F P O W E R > 2 . 0 **Radio/Mode** **Channel** **Frequency(MHz)** NOTE The = sign has been replaced with the > sign indicating the data entry mode.
4	To change the RF power to 0.5 watt, press the □ or □ key and then press ENTR (6, Figure 4-3) at this point. The menu screen will look like this: M 1 — R F P O W E R = 0 . 5 **Radio/Mode** **Channel** **Frequency(MHz)**
5	The display will remain in the current menu selection with the new data and the = sign displayed for verification.

4-9.2.2.6 RX IF Bandwidth.

Change RX IF bandwidth as indicated in Table 4-18.

Table 4-18. RX IF Bandwidth

Step	Procedure
1	The RX IF bandwidth is programmable for 136-174 MHz and 403-470 MHz receiver-transmitters only. After pressing the up arrow (□) key (7, Figure 4-3), the RX IF bandwidth menu will appear as follows: M 1 — RX IFBW = 25.0 **Radio/Mode** **Channel** **Frequency(MHz)**
2	If the RX IF bandwidth level is correct, press the up arrow (□) key (7, Figure 4-3) to proceed to the next menu.
3	If the RX IF bandwidth level needs to be changed, press the ENTR key (6, Figure 4-3) at this point. The data entry screen will appear as follows: M 1 — RX IFBW > 25.0 **Radio/Mode** **Channel** **Frequency(MHz)** NOTE The = sign has been replaced with the > sign indicating the data entry mode.
4	To change the RX IF bandwidth to 12.5 kHz, press the □ or □ key and then press ENTR (3, Figure 4-3). The menu screen will look like this: M 1 — RX IFBW = 12.5 **Radio/Mode** **Channel** **Frequency(MHz)**
5	The display will remain in the current menu selection with the new data and the = displayed for verification.

4-9.2.2.7 Secure Data Rate.

Change secure data rate as indicated in Table 4-19.

Table 4-19. Secure Data Rate

Step	Procedure
1	After pressing the ↑ key (7, Figure 4-3), the secure rate menu will appear as follows: M 1 — S E C U R E R T = 1 6 **Radio/Mode** **Channel** **Frequency(MHz)**
2	If the secure rate is correct, press the ↑ key to proceed to the next option.
3	If the secure rate needs to be changed, press the ENTR key (6, Figure 4-3) at this point. The data entry screen will appear as follows: M 1 — S E C U R E R T > 1 6 **Radio/Mode** **Channel** **Frequency(MHz)** NOTE The = sign has been replaced with the > sign indicating the data entry mode.
4	To change the secure data rate to 12 kbps, press the ↑ or ↓ key and then press ENTR. The display will look like this: M 1 — S E C U R E R T = 1 2 **Radio/Mode** **Channel** **Frequency(MHz)**
5	The display will remain in the current menu selection with the new data and the = sign displayed for verification.

4-9.2.3 Programming Options.

At the PRGM CHAN? menu, use the arrow keys to scroll through the following menus: squelch LVL, TX timeout, clone, or zeroize radio. Each of these options are explained in Table 4-20.

Table 4-20. Programming Options

Step	Procedure
	SQUELCH LEVEL
1	After depressing the up arrow (□) key (7, Figure 4-3) at the PRGM CHAN? prompt, the squelch level menu will appear as follows: M — S Q L C H L V L = 1 2 **Radio/Mode** **Channel** **Frequency(MHz)**
2	If the squelch level is correct, press the up arrow (□) key (7, Figure 4-3) to proceed to the next option.
3	If the squelch level needs to be changed, press the ENTR key (6, Figure 4-3) at this point. The data entry screen will appear as follows: M — S Q L C H L V L > 1 2 **Radio/Mode** **Channel** **Frequency(MHz)** NOTE The = sign has been replaced with the > sign indicating the data entry mode.
4	To change the squelch level to 14 dB, scroll through the values using the arrow keys until 14 is displayed and then press ENTR (6, Figure 4-3). The menu screen will look like this: M — S Q L C H L V L = 1 4 **Radio/Mode** **Channel** **Frequency(MHz)**
5	The display will remain in the current menu selection with the new data and the = displayed for verification.
	TX TIMEOUT
6	After depressing the up arrow (↑) key, the TX timeout menu will look like this: M — T X T I M E O U T = 3 0 **Radio/Mode** **Channel** **Frequency(MHz)**
7	If the TX timeout is correct, press the up arrow (□) key (7, Figure 4-3) to proceed to the next option.
8	If you wish to adjust the TX timeout, press the ENTR key (6, Figure 4-3). The menu will appear as follows: M — T X T I M E O U T > 3 0 **Radio/Mode** **Channel** **Frequency(MHz)**

Table 4-20. Programming Options - CONT

Step	Procedure
	TX TIMEOUT - CONT
	NOTE The = sign has been replaced with the > sign indicating the data entry mode.
9	To change the TX timeout to 90 seconds, scroll through the values using the arrow keys until 90 is displayed and then press ENTR (6, Figure 4-3). The screen will look like this: M | T X T I M E O U T = 9 0 **Radio/Mode** **Channel** **Frequency(MHz)**
10	The display will remain in the current menu selection with the new data and the = displayed for verification.
	CLONE CONTROL
11	After pressing the up arrow (□) key, the clone control menu will look like this: M | C L O N E = S L A V E **Radio/Mode** **Channel** **Frequency(MHz)**
12	If the clone control menu is correct, then press the up arrow (□) key (7, Figure 4-3) to proceed to the next option.
13	If you wish to change the clone mode, press the ENTR key (6, Figure 4-3). The data entry screen will appear as follows: M | C L O N E > S L A V E **Radio/Mode** **Channel** **Frequency(MHz)**
	NOTE The = sign has been replaced with the > sign indicating the data entry mode.
14	To change the clone mode to MASTER, scroll through the values using the arrow keys until MASTER is displayed and then press ENTR (6, Figure 4-3). The screen will look like this: M | C L O N E = M A S T E R **Radio/Mode** **Channel** **Frequency(MHz)**
15	The display will remain in the current menu selection with the new data and the = displayed for verification.

4-9.2.4 Zeroize Receiver-Transmitter.

The zeroize function programs the TX and RX frequencies to 0 MHz for all channels and sets all remaining programmable parameters to factory default values. The COMSEC encryption keys in the receiver-transmitter cannot be zeroized from the base station operator panel. The encryption keys can only be zeroized by turning the receiver-transmitter mode switch to Z, or by removing all power sources (base station sleeve, battery) from the receiver-transmitter for more than 90 seconds. Zeroize the receiver-transmitter as indicated in Table 4-21.

Table 4-21. Zeroize Receiver-Transmitter

Step	Procedure
1	After pressing the up arrow (□) key (7, Figure 4-3), the ZEROIZE RAD? screen will look like this: M — **Radio/Mode** Z E R O I Z E R A D ? — **Channel** **Frequency(MHz)**
2	If you wish to zeroize the receiver-transmitter channels and frequencies, press the ENTR key (6, Figure 4-3). The screen will appear as follows: O K — **Radio/Mode** T O Z E R O I Z E ? — **Channel** **Frequency(MHz)**
3	If you want to zeroize the receiver-transmitter, press the ENTR key (6, Figure 4-3) again to execute the zeroize receiver-transmitter function.
4	If you do not want to zeroize the receiver-transmitter at this time, press the CLR key (3, Figure 4-3). This will return you to the PRGM CHAN? menu.

4-9.2.5 Cloning Receiver-Transmitters.

Clone a receiver-transmitter as indicated in Table 4-22.

Table 4-22. Cloning Receiver-Transmitters

Step	Procedure
1	At the PRGM RADIO? prompt, press the ENTR key (6, Figure 4-3), then use the up arrow (↑) key (7, Figure 4-3) or down arrow (↓) key (4, Figure 4-3) to find the CLONE RADIO? as shown below: `[ ]` `C L O N E R A D I O ?` **Radio/Mode** **Channel** **Frequency(MHz)**
2	Press the ENTR key at the CLONE RADIO? prompt; the following menu appears for cloning the main to the guard receiver-transmitter: `S E L >` `C L O N E M T O G` **Radio/Mode** **Channel** **Frequency(MHz)**
3	Using the ↑ or ↓ keys at this point scrolls through the six different cloning operations. These are: CLONE MAIN TO GUARD CLONE GUARD TO MAIN CLONE MAIN TO EXTERNAL CLONE EXTERNAL TO MAIN CLONE GUARD TO EXTERNAL CLONE EXTERNAL TO GUARD
4	The source receiver-transmitter is first and the target is second. Pressing the ENTR key at any one of these six clone menus will begin the cloning process for the selected receiver-transmitters. Before beginning the cloning process, ensure the following: a. Both receiver-transmitters must be properly installed and/or connected. b. The source and target receiver-transmitters must be the same frequency band. c. The source receiver-transmitter must have a valid clone control parameter setting (i.e., master, slave, or no-change). d. If cloning an external receiver-transmitter, the unit must be properly connected using the programming cable (W5) and switched ON. NOTE Violating any one of the following rules will result in a CLONE ERROR or CLONE DSBL message on the display indicating it is an invalid cloning process.
5	The cloning process takes approximately 25 seconds to complete. A successful cloning operation is indicated by a CLONE DONE message on the display. An unsuccessful clone operation is indicated by a CLONE FAILED message on the display. Pressing the ENTR key at this point will return the display to the clone selection menus.

4-10 EQUIPMENT SHUT DOWN.

Shut down the base station as follows:

a. Place the POWER switch (1, Figure 4-2) in the OFF position.

b. Verify that the base station is off by pressing the PTT switch on the audio accessory and observing that the XMT (transmit) LED (3, Figure 4-1) is not illuminated.

Section III. EMERGENCY OPERATION

4-11 ELECTROMAGNETIC PULSE PROTECTION.

Electromagnetic Pulse (EMP) is a pulse of broad bandwidth, high amplitude radio frequency electromagnetic energy produced by the radiation from a nuclear burst.

4-11.1 EMP Susceptibility.

EMP can deliver a power density to a radio receiver a billion times greater than the power necessary for reception. The voltage and current surges resulting from EMP can overload most modern solid state electronic devices.

4-11.2 EMP Protective Measures.

All equipment not absolutely required in primary systems should remain disconnected and stored within a sealed shelter or other shielded enclosure for protection from EMP. To prevent or reduce "coupling" with the energy from EMP, wires and cables (to include output coaxial types) should be shielded and properly grounded. Lengths of cables should be kept as short as possible. Excess lengths of cable in use should never be left wound on a cable reel but should be pulled out in a straight line to avoid having loops in the cables. When cables are not needed, they should not be connected to the equipment. Burying cables a foot or more will reduce their exposure to EMP fields. Antennas and their connecting cables should be disconnected from radio sets when not in use. Narrow bandwidth antennas requiring high power for operation reduce the EMP coupling effect.

4-12 NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) CONTAMINATION.

The Scope Shield equipment has a Chemical Agent Resistant Coating (CARC) finish that reduces the susceptibility to NBC contamination. However, in the event the equipment does become contaminated, great care must be exercised in performing decontamination before the equipment can be returned to use. The power supply must be disconnected to prevent personnel injury and equipment damage. The best way to decontaminate communications equipment is with hot air, although metal surfaces exposed to blister agents and V-agents may be decontaminated with DS2. However, DS2 is highly corrosive and must be used with extreme care to avoid rendering equipment inoperable.

4-13 EMERGENCY POWER.

The base station can be powered directly from a battery installed in a vehicle for external power. Use the DC power supply cable assembly (SS-4500106-501) with the positive cable lugs (red) connected to the positive battery terminal and the negative cable lugs (blue/green/yellow) grounded to the vehicle frame.

CHAPTER 5 THEORY OF OPERATION

Section I. FUNCTIONAL SYSTEM(S) OPERATION

5-1 GENERAL.

This section describes the theory of operation of the base station.

From both technical and operational standpoints, the base station is a component of a communications system. The base station receiver-transmitters must function in conjunction with other receiver-transmitters to perform receiver-transmitter communication. However, the base station does not depend on other receiver-transmitters for its proper functioning or performance.

The base station serves as the control node of a communications network. The base station uses two receiver-transmitters. One receiver-transmitter provides the primary channel for routine traffic. The other receiver-transmitter provides a guard or emergency use channel which constantly monitors for traffic on the tuned guard channel.

The base station equipment operates in the 30-88, 136-174, or 403-470 MHz frequency bands. It uses frequency modulation (FM) analog voice in the non-secure modes, and encrypted digitized voice FM in the secure mode. The base station is interoperable with the AN/PRC-77 Manpack Radio, Radio Set AN/PRC-128, and the U.S. Army Single Channel Ground and Airborne Radio Subsystem (SINCGARS-V) in the fixed frequency mode. The base station provides compatibility with the VINSON family of COMSEC equipment when operating in the 16 kbps, and with FED-STD-1023 equipment when operating in the 12 kbps mode.

When operating in the secure mode, the receiver-transmitter used in the base station converts the analog voice to 16 kbps Continuously Variable Slope Delta Modulation (CVSD) digitized voice. This is encrypted in such a manner as to be interoperable with other receiver-transmitters that are VINSON compatible and operating at 16 kbps. The receiver-transmitter obtains this interoperability from an embedded INDICTOR COMSEC Module. The receiver-transmitter also operates at 12 kbps, compatible with FED-STD-1023.

5-2 FUNCTIONAL SYSTEM(S) OPERATION.

(See Figure 5-1.) Paragraphs 5-2.1 through 5-2.14 provide a limited system description of the main components and ancillary equipment used with the base station. A functional block diagram (Figure 5-1) shows the interrelationship between the main elements of the base station.

5-2.1 Main and Guard Receiver-Transmitters.

The main and guard receiver-transmitters included with the base station are Receiver-Transmitters RT-1696/U(C). The main receiver-transmitter provides the primary communication channel for voice communication. The guard receiver-transmitter provides an emergency communication channel which constantly monitors for traffic on the tuned guard channel. The receiver-transmitters provide transmit and receive capability in the 30-88, 136-174, or 403-470 MHz frequency bands, depending on the configuration of the receiver-transmitter installed. When installed in the base station, the receiver-transmitters provide communication in both secure and non-secure (clear) modes. The receiver-transmitters can operate either as the receiver-transmitter part of the Radio Set, AN/PRC-139(C) or installed in the base station.

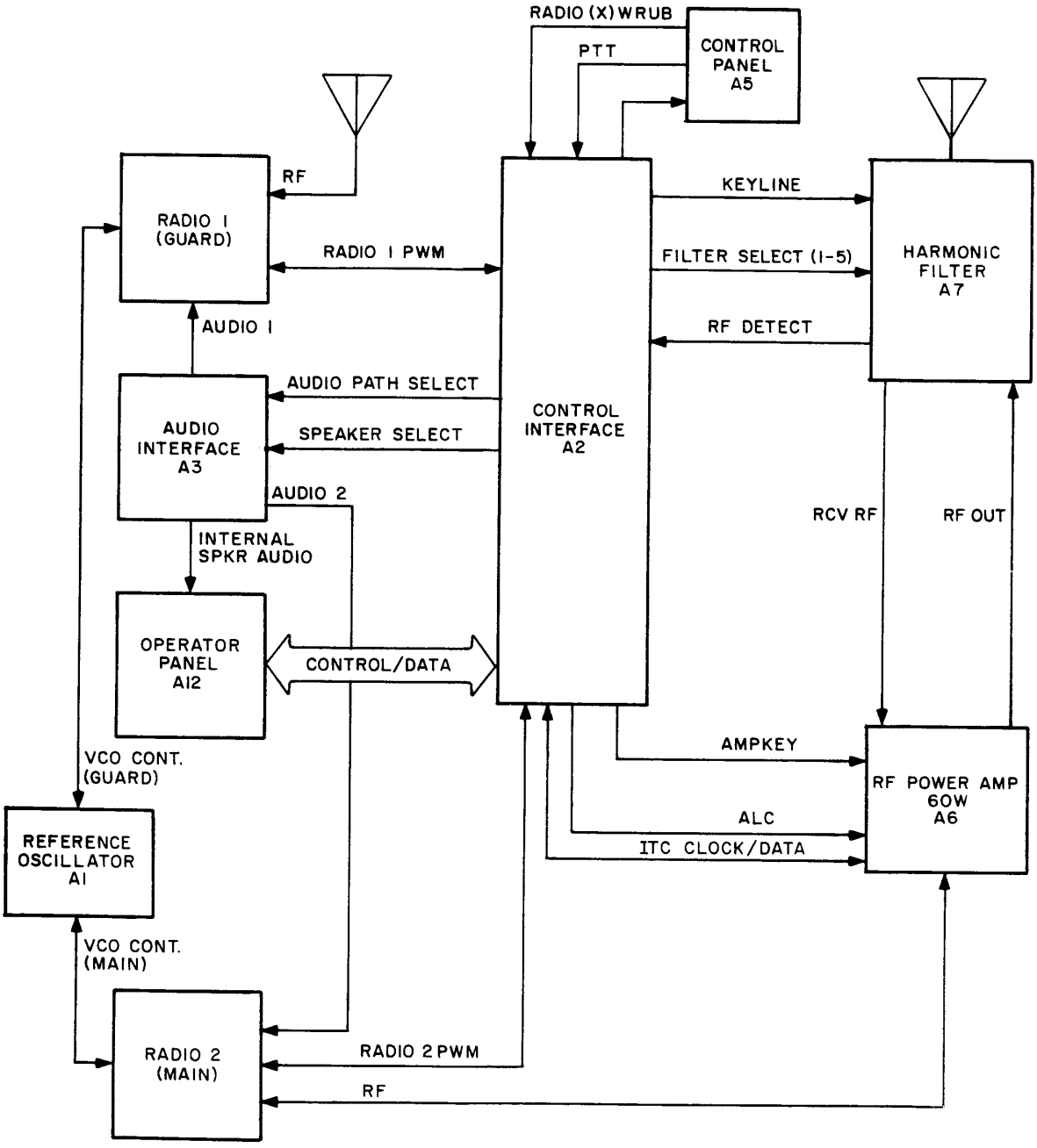


Figure 5-1. Base Station Block Diagram

5-2.2 Antenna System

The antennas provide limited simultaneous transmit and receive capability using separate antennas for the main and guard channels. Six antennas are used to cover the three bands of operation, 30-88, 136-174, and 403-470 MHz frequency ranges, two (main and guard) for each of the three frequency bands. The antennas provide a gain in each band as follows:

Range	Gain
30-88 MHz	-7 dBi to +2 dBi (-9.14 dB to -0.14 dB relative to 1/2 wavelength dipole
136-174 MHz	+2.5 dBi or greater (>+0.36 dBD)
403-470 MHz	+2.5 dBi or greater (>+0.36 dBD)

The antennas provide omni-directional coverage over each of the specified frequency bands, when measured over an unobstructed ground plan.

5-2.3 Reference Oscillator Circuit Card Assembly (CCA) (A1).

The main purpose of the reference oscillator CCA (A1) is to increase the frequency stability of the receiver-transmitters. This is accomplished by comparing the receiver-transmitter reference frequency with a high stability temperature compensated crystal oscillator (TCXO) and supplying an error correction to the voltage controlled oscillator (VCO) in the receiver-transmitter. This module also contains the circuitry to divide the 5 MHz reference frequency of the TCXO down to 6.25 kHz, integrate the output signal of the phase detector, amplify the reference frequency signal of the receiver-transmitter (which is monitored by the phase detector), and a synchronization circuit to maintain a minimum phase shift between the two reference frequencies. The reference oscillator CCA has identical circuitry for the main and guard receiver-transmitters with a common reference oscillator TCXO circuit.

5-2.4 Control Interface Circuit Card Assembly (CCA) (A2).

The control interface CCA (A2) is a microcontroller-based assembly which performs system control, monitoring, and built-in diagnostic functions. It interfaces with and controls the main and guard receiver-transmitters, RF power amplifier, harmonic filter, audio interface assembly, operator panel assembly, and control panel assembly.

5-2.5 Audio Interface Circuit Card Assembly (CCA) (A3).

The audio interface CCA (A3) provides the audio interface between the receiver-transmitters and the base station control panel. Audio from the main and guard receiver-transmitters is buffered and mixed. Through the AUDIO MODE switch, the system operator can select main only audio, guard only audio, or a mix of main plus guard audio. The combination of audio signals is applied to a headset amplifier with volume control and a buffer amplifier that provides isolation between the headset and speaker amplifiers. The headset amplifier is capable of driving impedances to 600 ohms or greater and is internally protected against output short circuits to ground. The speaker amplifier is capable of supplying approximately 2 watts into an 8 ohm speaker. The speaker amplifier is internally protected against output short circuits and provides a thermal shutdown before the maximum junction temperature is reached. The speaker output is applied to an operator controlled switch circuit. The system operator selects the internal speaker only, external speaker only, or neither speaker. Both headset and speaker volume control circuits provide the operator with a choice of eight volume levels.

5-2.6 Parent Circuit Card Assembly (CCA) (A4).

The parent CCA (A4) provides the interconnection between the circuit card assemblies and provides DC power to the receiver-transmitters.

5-2.7 Control Panel Assembly (A5).

The control panel assembly (A5) mounts all of the base station switches.

5-2.8 Power Amplifier Assembly (A6).

The power amplifier (A6) provides RF amplification for the output of the receiver-transmitter inserted in the base station main receiver-transmitter sleeve. The output of the receiver-transmitter is amplified to 5 watts, 16 watts, or 40 watts as selected by the POWER switch. The power amplifier covers the entire frequency range of 30-470 MHz inclusive, with transceiver operation in the 30-88 MHz, 136-174 MHz, and 403-470 MHz frequency bands.

5-2.9 Harmonic Filter Assembly (A7).

The primary purpose of the harmonic filter assembly (A7) is to attenuate unwanted emissions from the transmit signal. The module also contains circuitry to allow monitoring of the RF transmit power level for the main channel. The RF input and output impedance is 50 ohms nominal. The module is capable of handling input signal levels up to 60 watts with no more than 1 dB insertion loss. Input and output voltage standing wave ratio (VSWR) is less than 2:1. The communications system operates on three bands; 30-88 MHz, 136-174 MHz, and 403-470 MHz. In order to attain adequate harmonic attenuation, the 30-88 MHz band is divided into three sub-bands, each with an associated filter. One filter is used for 136-174 MHz and another for the 403-470 MHz frequency band.

5-2.10 Operator Panel Assembly (A12).

The operator panel assembly (A12) provides the necessary driver/interface circuitry and mounting/connections for the four programmable LED display modules, the 20-position matrix keypad, the three discrete LED indicators and the internal loudspeaker used on the base station operator panel assembly.

5-2.11 Base Station Power Supply.

The power supply provides regulated power for the operation of the base station. The power supply operates from any of the following power sources:

a. 120/240 VAC " 10% (1 phase, 3 wire) 50-60 Hz
b. 220 VAC " 10% (1 phase, 2 wire) 50 Hz
c. 10-32 VDC

5-2.12 Primary Battery Tray.

The primary battery tray provides a 24 volt DC power source for operation of the base station in locations without other sources of AC or DC power. The tray is designed to hold 12 BA-5590 lithium batteries connected in series, but BB-590/U rechargeable nickel-cadmium batteries can also be used. In normal use (2:4:4 transmit/receive/standby ratio) at 5 watts RF output power, the lithium batteries will provide approximately 24 hours of operation.

5-2.13 External Loudspeaker.

The external speaker provides audio output and is capable of handling 10 watts of continuous audio power.

5-2.14 Hand Microphone.

This is a hand-held, PTT microphone of the noise-canceling type. It uses a standard audio connector (U-329/U). The microphone has a frequency response of:

300 Hz to 1.5 kHz " 6 dB
1.5 kHz to 3.5 kHz + 8dB/- 3 dB

5-2.15 Headset with Boom Microphone.

The headset gives the operator the flexibility and freedom to move within the operational control center. The boom microphone reduces noise. Transmission control is via a PTT switch that is located on a belt-worn control box that connects to the headset and to the base station headset connector via a standard audio connector (U-329/U). The microphone has a frequency response of:

300 Hz to 1.5 kHz " 6 dB
1.5 kHz to 3.5 kHz + 8dB/- 3 dB

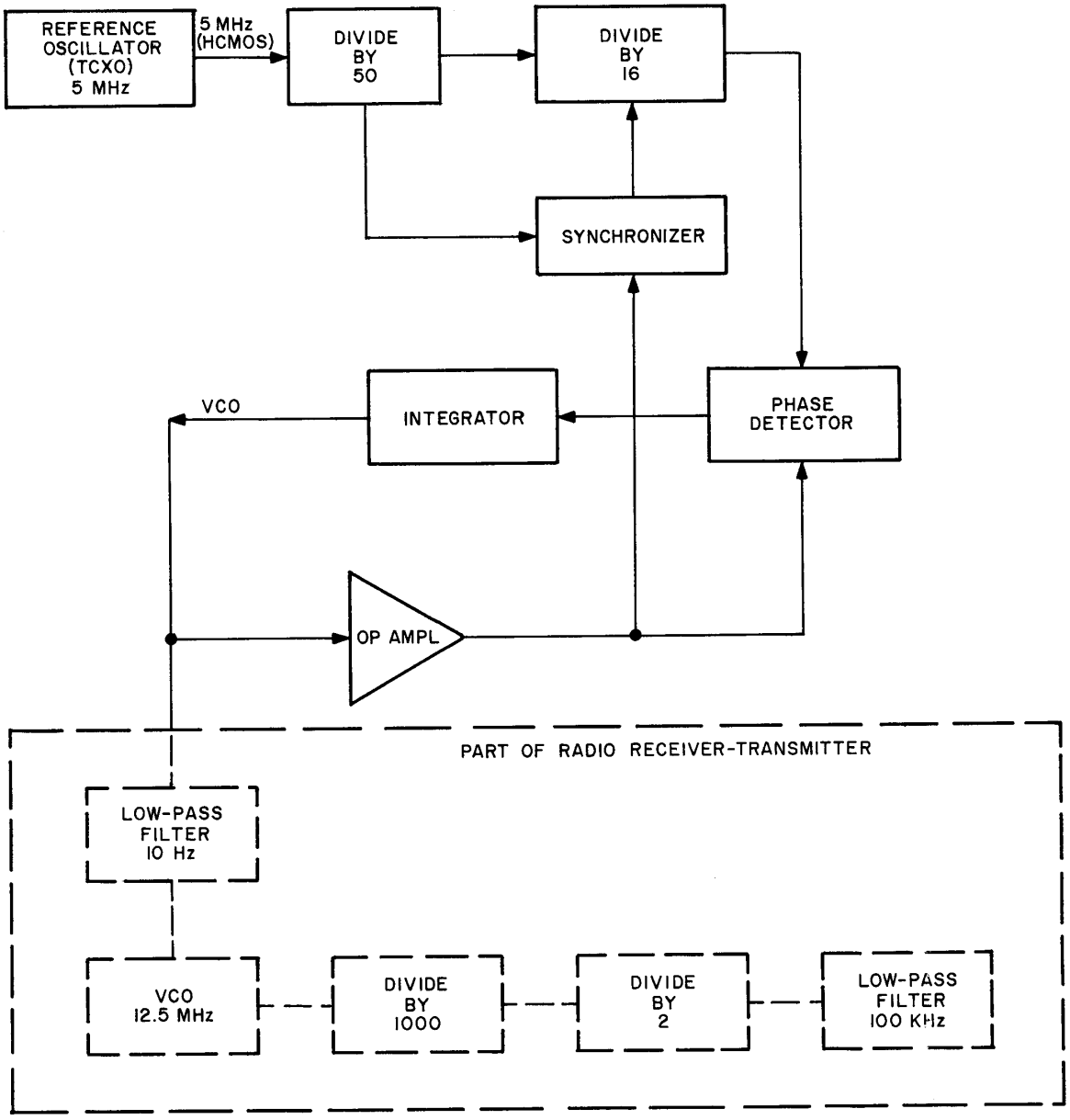


Figure 5-2. Reference Oscillator CCA (A1), Functional Block Diagram

Section II. FUNCTIONAL OPERATION OF ELECTRONIC CIRCUITS

5-3 REFERENCE OSCILLATOR CIRCUIT CARD ASSEMBLY (CCA) (A1).

Refer to Figure 5-2 for the block diagram for the reference oscillator CCA (A1). As shown in Figure 5-2, the reference oscillator CCA (A1) consists of the following major functional elements:

a. Reference Oscillator (TCXO)
b. Divide-by-16 counter
c. Integrator
d. Synchronizer Circuit
e. Divide-by-50 counter
f. Phase Detector
g. Operational Amplifier
h. Voltage regulator

5-4 CONTROL INTERFACE CIRCUIT CARD ASSEMBLY (CCA) (A2).

Paragraph 5-4.1 provides an overview of the system interfaces performed by the control interface CCA. This includes a description of all the applicable signals. As shown in the control interface CCA block diagram (FO-2), the control interface CCA consists of the following major functional elements:

a. 8-Bit microcontroller with on-chip EPROM and RAM memories
b. Multifunction programmable logic cell array (LCA)
c. 8-channel analog mux.
d. A/D (analog-to-digital) and D/A (digital-to-analog) converter
e. Pulse width modulation (PWM) drivers/transceivers
f. Octal bus transceiver
g. Output buffer
h. RS-232C receiver/driver
i. MOSFET drivers
j. Built-in diagnostics
k. Power regulator

5-4.1 System Interfaces.

(See Figure 5-3.) Paragraphs 5-4.1.1 through 5-4.1.8 describe the system interfaces performed by the control interface CCA.

5-4.1.1 Guard Receiver-Transmitter Interface.

The control interface CCA continuously monitors the HH1SQLCH signal to U9, pin 26, to determine receive signal presence on the guard channel. An active-high (1 mA into 4.7k ohms) HH1SQLCH input (receive signal on guard channel) causes the control interface CCA to illuminate the GUARD LED and sound a 1190 Hz audible tone from the selected speaker. The HH1PWM bi-directional signal line serves as the PWM serial communications interface between the guard receiver-transmitter and the control interface CCA. Programming and status information is exchanged between the control interface CCA and guard receiver-transmitter using this serial interface.

5-4.1.2 Main Receiver-Transmitter Interface.

The HH2SQLCH signal to U9, pin 42 alerts the control interface CCA of the receive signal status on the main receiver-transmitter. The HH2PWM bi-directional signal line serves as the PWM serial communications interface between the main receiver-transmitter and the control interface CCA. Programming and status information is exchanged between the control interface CCA and main receiver-transmitter using this serial interface.

5-4.1.3 RF Power Amplifier Interface.

The control interface CCA adjusts the gain of the 60 watt power amplifier assembly (A6) via the automatic level control (ALC) output signal, U2B pin 7 through a D/A converter, U3 pin 2. The control interface CCA determines the setting for the ALC voltage level based on the following four factors: the control panel power selection, the transmit frequency, the RF power calibration value stored in the amplifier EPROM. The control panel power selection, the transmit frequency, and EEPROM calibration table also provide the control interface CCA with the target voltage range for the RFDET input.

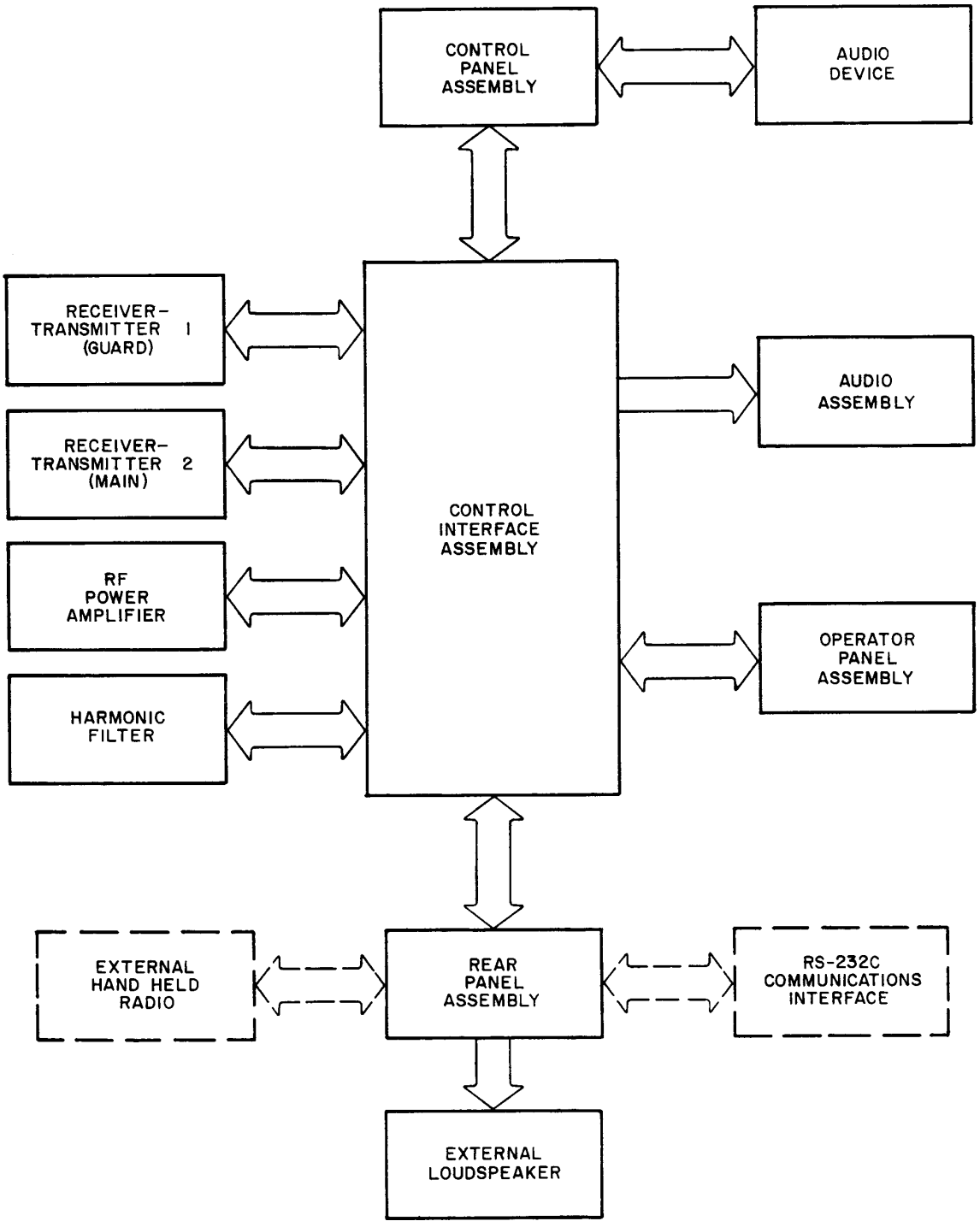


Figure 5-3. System Interface Diagram

The control interface CCA uses the AMPKEY output logic signal, U9 pin 51, to key and unkey the 60 watt power amplifier based upon the operator PTT input, U5 pin 12. The PATEMP signal at U4, pin 12 alerts the control interface CCA of an over-temperature condition on the 60 watt power amplifier. The control interface CCA initially tries to reduce the output power level using the ALC gain control. If this fails to fix the problem then the control interface CCA will simply unkey the amplifier.

5-4.1.4 Harmonic Filter Interface.

The control interface CCA selects one out of five harmonic filters used in the RF transmit path based on the transmit operating frequency. Every time the receiver-transmitter is keyed, the control interface CCA will read the transmit frequency information from the receiver-transmitter via the PWM serial bus and select the appropriate harmonic filter based on this frequency. Filter selection occurs only for the main channel since the guard channel RF output is routed directly to the antenna port. The signal lines used to select the in-line harmonic filter are FILSEL1, FILSEL2, FILSEL3, FILSEL4 and FILSEL5. The microcontroller, U5, turns on transistor Q8, Q9, Q11, Q13, or Q14 based on which filter is selected. FILSEL1 selects the 30 to 43 MHz filter; FILSEL2 selects the 43 to 61 MHz filter; FILSEL3 selects the 61 to 88 MHz filter; FILSEL4 selects the 136 to 174 MHz filter and FILSEL5 selects the 403 to 470 MHz filter. The RFDET input to U4, pin 14 from the harmonic filter assembly (A7) is used to monitor the transmit RF power level.

5-4.1.5 Audio Interface CCA.

The control interface CCA controls the speaker selection on the audio interface CCA using the SPKRSEL0 and SPKRSEL1 logic signals. Speaker selection is established by reading the front panel SPEAKER selection three-position switch. Similarly, the control interface CCA controls the receive audio path on the audio interface CCA using the AUDIOSEL0 and AUDIOSEL1 logic signals according to the control panel AUDIO selection four-position switch. The control interface CCA toggles the BEEP line at a rate of 1190 Hz for approximately 0.2 second upon initial reception of an RF signal on the guard receiver-transmitter in the base station.

The control interface CCA also controls the speaker and headset volume on the audio interface CCA. This is done by reading the binary coded decimal (BCD) encoder inputs SPKRVOLSW0 through SPKRVOLSW2 for the speaker and HSETVOLSW0 through HSETVOLSW2 for the headset. These inputs are then used to directly set the outputs SPKRVOL0 through SPKRVOL2 for the speaker volume and HSETVOL0 through HSETVOL2 for the headset volume on the audio interface CCA.

The AUDIOENB signal is used to enable/disable the audio interface CCA. Setting the AUDIOENB to logic 1 will power the audio interface CCA, while a logic 0 will disable power to the audio interface CCA. This power sequence is used by the control interface CCA to conserve power and reduce audio noise by enabling the audio interface CCA only when needed.

5-4.1.6 Operator Panel Interface.

The control interface CCA uses its buffered 8-bit bi-directional address/data bus ADX0 through ADX7 along with control signals KEYDOWN, OPALE, OPRD and OPWR to control/monitor the keypad and display on the operator panel assembly. The FAULTLED, XMTLED and GUARD/STBY signals are used by the control interface CCA to control the FAULT, TRANSMIT and GUARD LEDs, respectively, on the operator panel.

5-4.1.7 Control Panel Interface.

The control panel switch selections are continuously polled and debounced by the control interface CCA on every pass through the firmware's main loop. The control interface CCA measures the HH1WRUB analog input voltage via the analog-to-digital (A/D) converter, U3, to determine whether or not a receiver-transmitter is plugged into the guard channel of the base station. Similarly, the control interface CCA measures the HH2WRUB analog input voltage via the A/D converter to determine whether or not a receiver-transmitter is plugged into the main channel of the base station. The control interface CCA uses the XMTLED, FAULTLED, GUARD/STBY, FASTLED and READYLED output logic signals to control the front panel LEDs on the base station.

5-4.1.8 I^2C Serial Interface.

The I^2C serial interface is a bi-directional synchronous two-wire interface consisting of a clock (IICCLK) and data (IICDATA) line. The interface is used on the serial EEPROM located on the power amplifier assembly to transfer data to/from the serial EEPROM from/to the microcontroller.

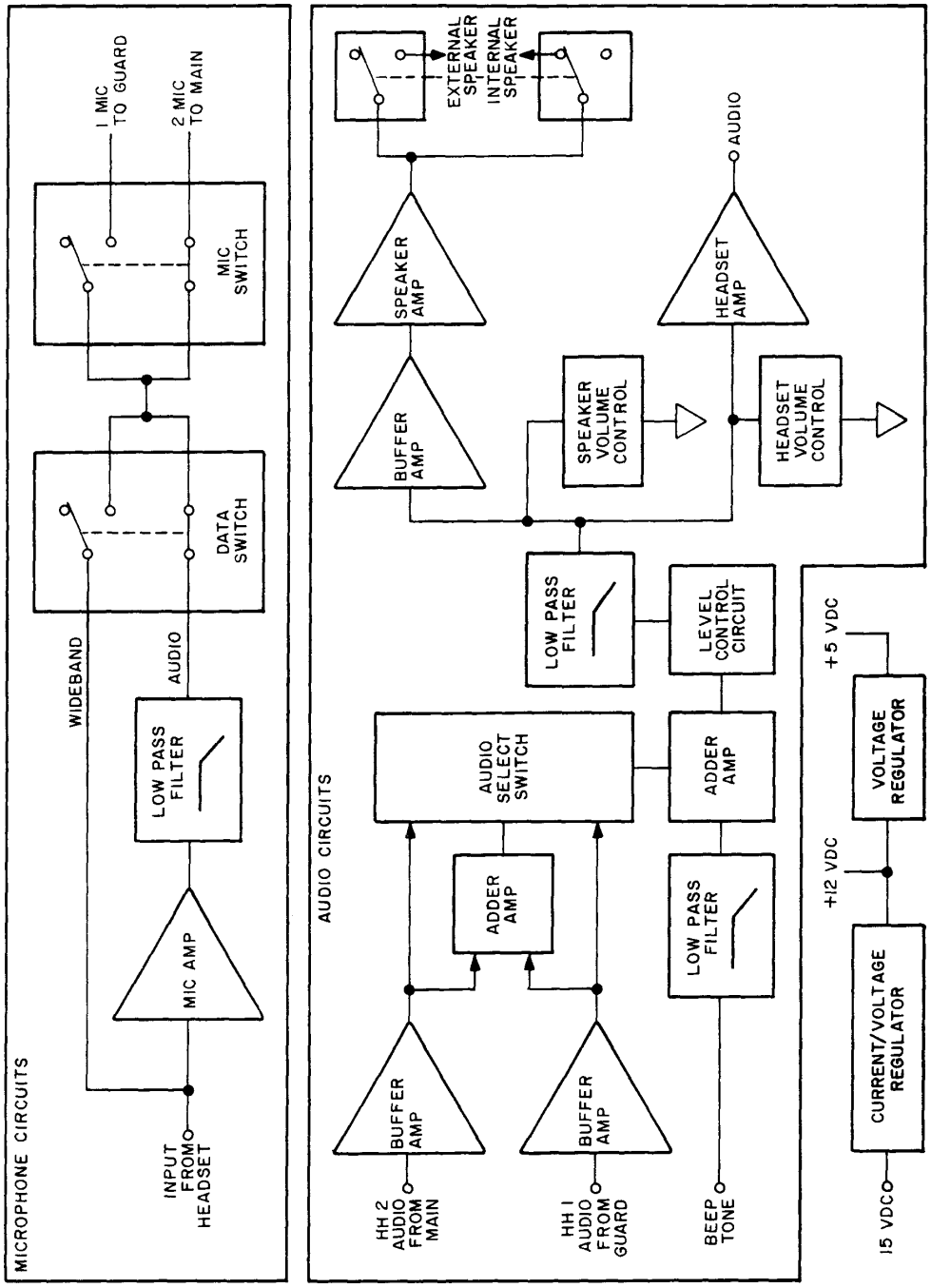


Figure 5-4. Audio Interface CCA (A3), Functional Block Diagram

5-5 AUDIO INTERFACE CIRCUIT CARD ASSEMBLY

Refer to Figure 5-4 for the block diagram for the audio interface CCA (A3). As shown in Figure 5-4, the audio interface CCA (A3) consists of the following functional elements:

a. Microphone circuits
b. Audio circuits
c. Current/voltage regulator

5-6 60 WATT POWER AMPLIFIER ASSEMBLY (A6).

Refer to Figure 5-5 for the block diagram for the 60 watt power amplifier assembly (A6). As shown in Figure 5-5, the 60 watt power amplifier assembly (A6) performs the following major functional elements:

a. RF signal path and AMPKEY control
b. Automatic level control
c. Manual level control
d. RF detector
e. Thermal protection
f. Current limiting
g. EEPROM
h. Voltage regulators

5-7 HARMONIC FILTER ASSEMBLY (A7).

Refer to Figure 5-6 for the block diagram for the harmonic filter assembly (A7). As shown in Figure 5-6, the harmonic filter assembly (A7) consists of the following major functional elements:

a. Five low pass filter networks
b. RF input detection circuits
c. RF output

5-8 OPERATOR PANEL CCA (A12A1).

As shown in Figure 5-7, the operator panel CCA consists of the following major functions:

a. 16-character dot matrix display
b. Address latch
c. LED drivers and indicators
d. Bi-directional buffer
e. 20-key matrix keypad
f. Keypad scanning network

Section III. FUNCTIONAL OPERATION OF MECHANICAL ASSEMBLIES

Not Applicable.

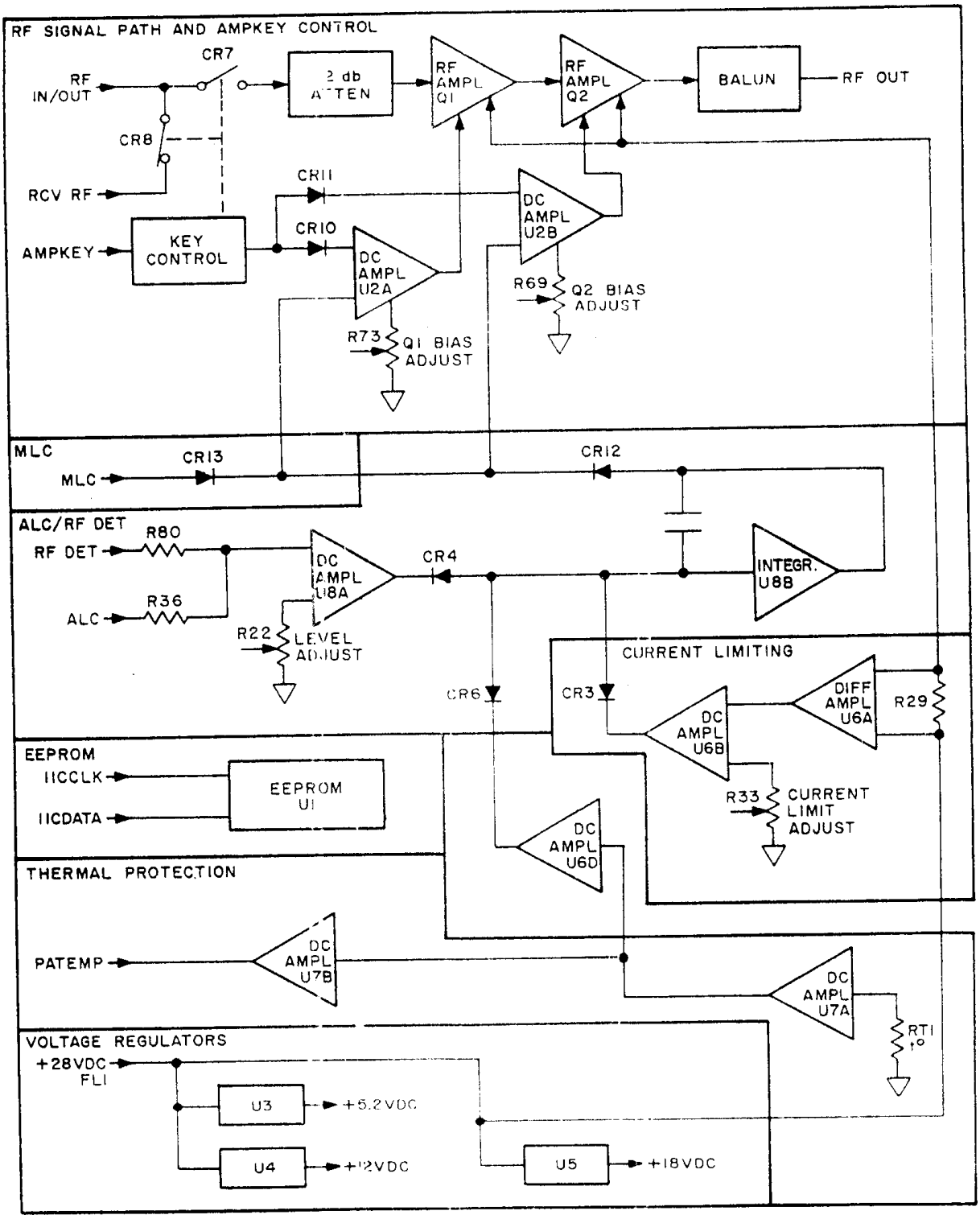


Figure 5-5. 60 Watt Power Amplifier Assembly (A6), Functional Block Diagram

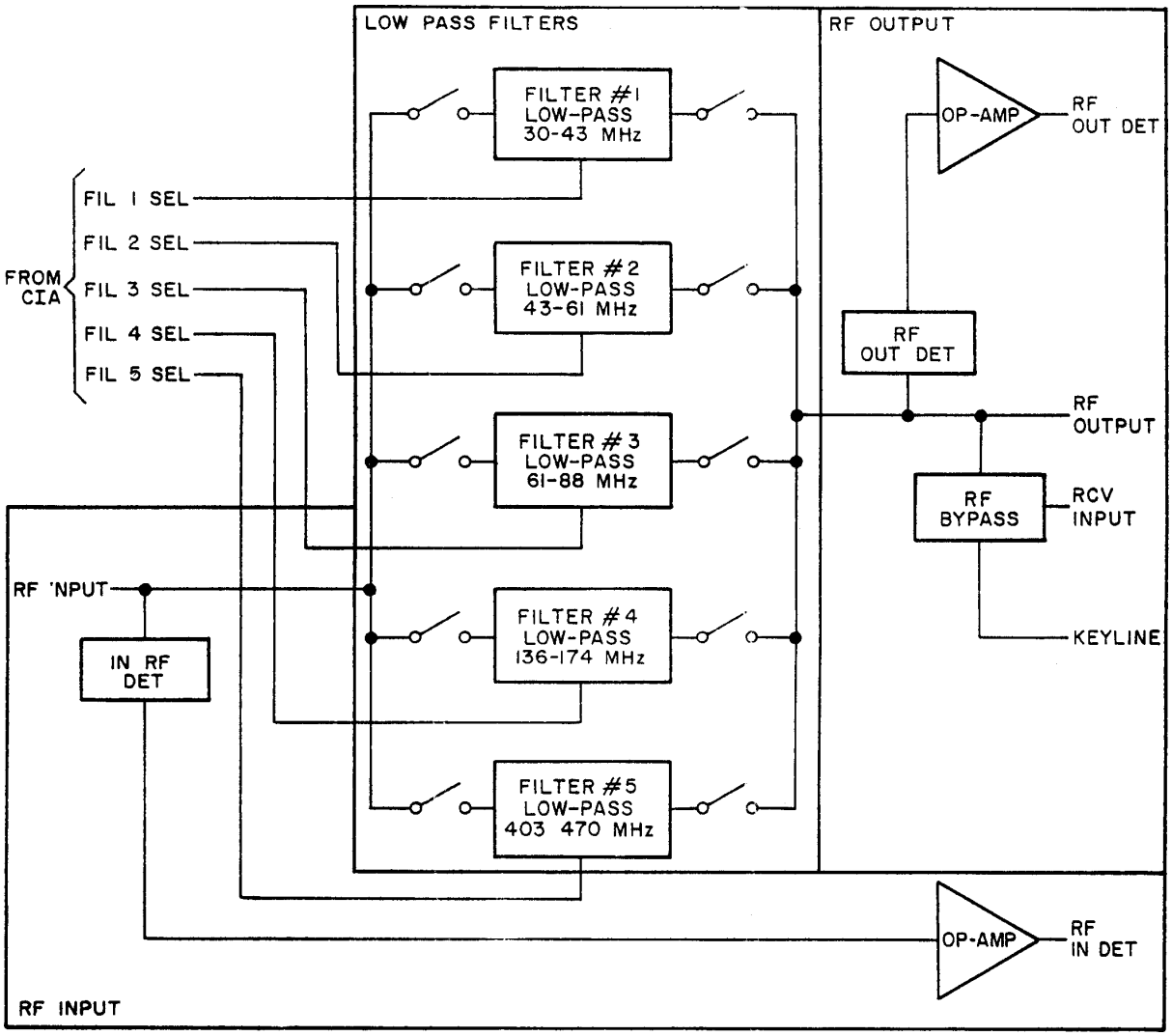


Figure 5-6. Harmonic Filter Assembly (A7), Functional Block Diagram

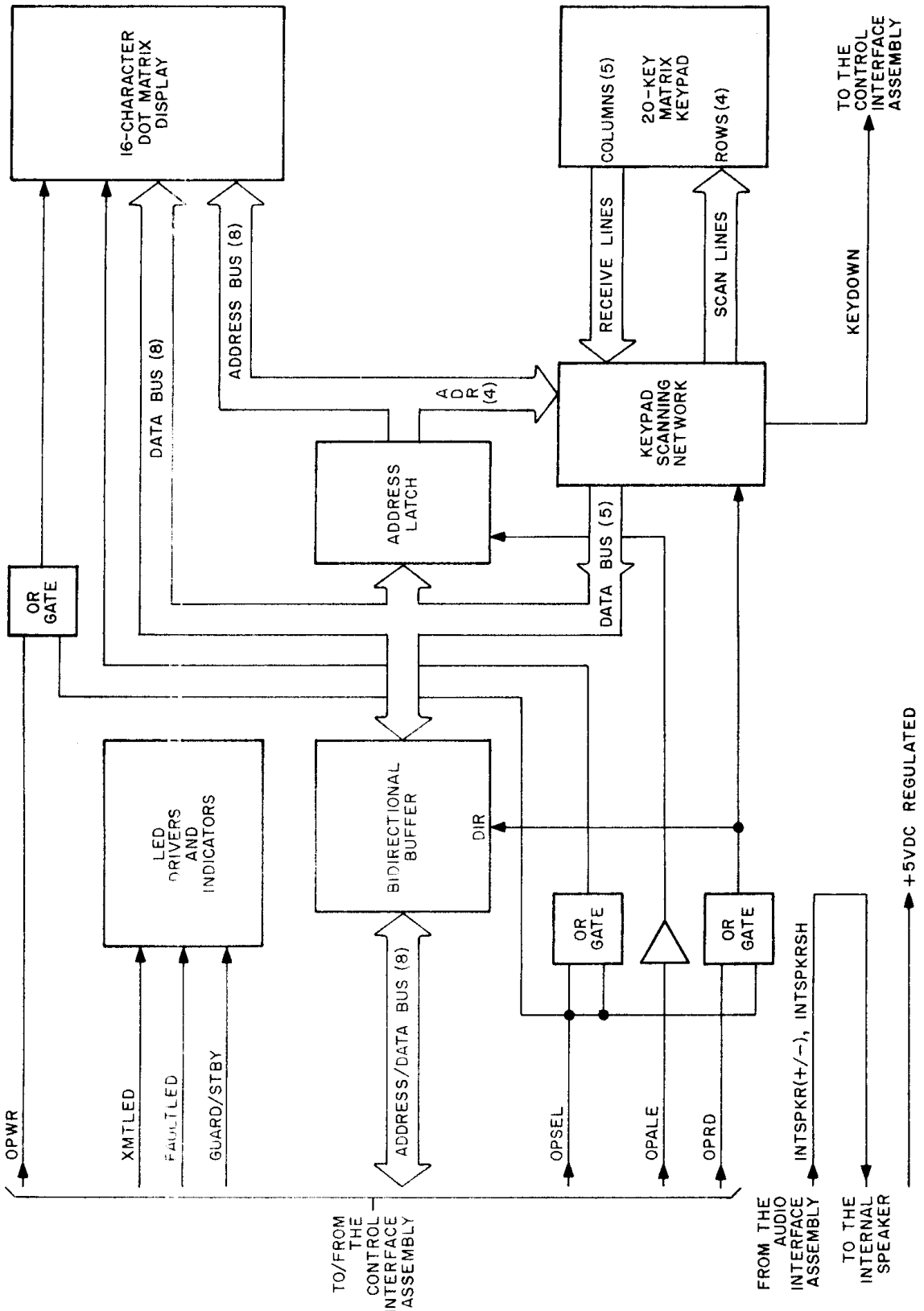


Figure 5-7. Operator Panel CCA (A12A1), Functional Block Diagram

CHAPTER 6 MAINTENANCE

6-1 GENERAL.

This chapter provides organizational maintenance instructions for the base station. This includes operational checkout, inspection and preventive maintenance, troubleshooting, and removal/replacement procedures.

NOTE

Prior to conducting the operational checkout, the receiver-transmitter used in the test must be properly programmed and configured. Refer to TO 31R2-2PRC139-1.

6-2 OPERATIONAL CHECKOUT.

Perform the procedures in paragraphs 6-2.1 through 6-2.4 to check the base station for normal operation. These checks should be performed when equipment is used for the first time, when there is a possibility that the equipment has been damaged, or if the equipment has not been used for an extended period of time.

NOTE

Prior to conducting the operational checkout, the receiver-transmitters used in the test must be properly programmed and configured, including loading of COMSEC keys. Refer to TO 31R2-2PRC139-1 for COMSEC key loading. Remote unit refers to another receiver-transmitter which the unit under test (UUT) can either transmit to or receive from.

6-2.1 Base Station Test Mode.

Check the base station test mode as follows:

a. Ensure that the base station has been installed as indicated in paragraph 2-10. Refer to the base station interconnection diagram (FO-1).

b. Set the base station switches and controls as indicated in Table 6-1.

Table 6-1. Initial Switch and Control Settings for Operational Checkout

Switch/Control	Position
POWER switch (1, Figure 4-2)	OFF
SQUELCH DISABLE switch (2, Figure 4-2)	OFF
SPEAKER switch (3, Figure 4-2)	INT
AUDIO MODE switch (7, Figure 4-2)	MAIN
HEADSET VOLUME switch (5, Figure 4-2)	Mid Position
SPEAKER VOLUME switch (4, Figure 4-2	Mid Position
Main Receiver-Transmitter Operating Mode switch	CL:R
Guard Receiver-Transmitter Operating Mode switch	CLR

c. While pressing any key on the base station keypad (see Figure 4-3), place the POWER switch in the 5W position. The unit will first cycle through a lamp test mode in which the amber GUARD (1, Figure 4-1), red FAULT (2, Figure 4-1), and amber XMT (3, Figure 4-1) status indicators and all segments of the RADIO/MODE and CHANNEL/FREQUENCY (MHz) displays are all turned on at full brightness for approximately 2 seconds. TEST MODE will then be displayed on the CHANNEL/FREQUENCY (MHz) display for approximately 2 seconds.

d. Observe that the display cycles through its internal character set at approximately two characters per second.

e. Press each key of the keypad in sequence. The display will indicate the key that was pressed and a beep tone will be emitted from the internal loudspeaker.

f Check the switches on the control panel (see Figure 4-2) by activating each switch position. The display will flash an indication of the function that has been activated for approximately 2 seconds.

g. Exit the test mode by either pressing the two outermost keys simultaneously (⇑ and ENTR) or placing the POWER switch in the OFF position.

6-2.2 Power-Up Verification.

Check the base station power-up operation as follows:

a. Set the base station switches and controls as described in Table 6-1.

b. Place the POWER switch (1, Figure 4-2) in the 5W position.

c. After the unit cycles through the lamp test as described in paragraph 6-2.1, SYSTEM READY will then be displayed on the display for approximately 4 seconds.

d. Press the PTT switch on the hand mike. Observe that the XMIT LED on the operator panel is illuminated and that the transmit LED on the Main radio is illuminated. Release the PTT.

e. The base station is now in an operational ready mode, displaying the main receive frequency on the display.

6-2.3 Display Brightness Control.

Check display brightness control as follows:

a. Press the down arrow (↓) key (4, Figure 4-3) while observing the display. Ensure that depressing the key causes the display to dim to its medium illumination level.

b. Press the down arrow (↓) key again while observing the display. Ensure that the display dims to its lowest illumination level.

c. Press the down arrow (↓) key again while observing the display and indicators. Ensure that the display, the three operator panel status indicators, and the guard and main receiver-transmitters XMT LEDs dim to no illumination.

d. Press the up arrow (↑) key (7, Figure 4-3) while observing the display. Ensure that the display returns to its lowest illumination.

e. Press the up arrow (↑) key once again while observing the display. Ensure that the display brightness increases to its medium illumination level.

e. Press the up arrow (↑) key once again while observing the display. Ensure that the display brightness increases to its highest illumination level.

6-2.4 Channel and Frequency Settings Check.

Perform the channel and manual frequency entry procedures of paragraphs 4-7 and 4-6, respectively, to check the capability of manually entering channels and frequencies.

6-3 SERVICING.

6-3.1 Servicing Intervals.

Table 6-2 provides recommended service intervals.

Table 6-2. Recommended Service Intervals

Task	Recommended Interval			
	D	W	M	Q
Visual inspection (see paragraph 6-3.2)	X			
Preventive maintenance:				
Inspection (see paragraph 6-3.3.1)		X		
Cleaning (see paragraph 6-3.3.2)		X		

D = Daily
W = Weekly
M = Monthly
Q = Quarterly

6-3.2 Inspection.

Many potential or existing faults can be detected by making a visual inspection of the equipment. For this reason, a complete visual inspection should be made on a routine basis or whenever the base station is inoperative.

At a minimum, the following items should be inspected by the operator.

NOTE

If any discrepancies are observed, return the unit to higher level maintenance.

a. Inspect the equipment covers and front panel for condition of finish and panel markings.

b. Inspect for dents, punctures and warped areas.

c. Inspect external surfaces for loose or missing screws or washers.

d. Inspect the receptacles and connectors for condition of pins, contacts and mounting.

e. Inspect audio accessory cables for abrasion or wear.

f. Inspect the antenna for signs of mechanical damage.

g. Inspect the knobs and switches for mechanical integrity.

6-3.3 Preventive Maintenance.

The base station requires no scheduled maintenance other than inspection and cleaning. At regular intervals (see Table 6-2) the operator shall perform the following procedures:

6-3.3.1 Inspection.

Inspect the base unit as follows:

a. Inspect the unit for dents, punctures, worn areas, broken knobs, or loose cable connections.

b. Inspect for loose or missing screws or washers.

c. Inspect LEDs for dust accumulation.

6-3.3.2 Cleaning.

Clean the base unit as follows:

a. Cleaning should be performed to remove accumulated dust and other contaminants.

b. Dust the switches and LEDs with a soft-bristled brush.

c. Remove dirt clinging to the base station with a clean, lint-free cloth dampened with a mild detergent and water solution. Avoid using abrasive cleaners as they will scratch the unit's surface.

d. Wipe internal sleeve contacts (connection to the receiver-transmitter) with a clean, dry, lint-free cloth.

6-4 TROUBLESHOOTING.

Tables 6-4 and 6-5 describe possible system malfunctions, their probable cause(s), and the corrective action required by the operator/repair specialist to return the equipment to an operational state. All solutions which suggest replacement of an item assume that the item used to make the replacement is a known good item.

Table 6-4 contains the symptoms of possible system malfunctions which can be acted on by the operator. Only those procedures contained within Table 6-4 are authorized to be performed by the operator. Table 6-5 identifies additional possible system malfunctions that can be corrected by the repair specialist. Troubleshooting procedures contained in Tables 6-4 and 6-5 are authorized to be performed by the repair specialist. Prior to performing any repair actions, the repair specialist should perform the following inspections:

a. The repair specialist should inspect those items which were inspected by the operator.

b. Inspect the internal components for signs of deterioration, discoloration, or charring. Check for melted insulation and damaged, cracked or broken components.

c. Inspect the printed circuit boards for damaged tracks, loose connections, corrosion, or other signs of deterioration.

d. Inspect the printed circuit (PC) connectors, interface connectors, and chassis wiring for excessive wear, looseness, misalignment, corrosion, or other signs of deterioration.

Table 6-3 lists and describes fault messages which can be displayed on the base station display. Table 6-6 provides a cross-reference to applicable removal/replacement procedures.

NOTE

Before attempting to correct any system malfunctions by removing/replacing suspected failed items, the operator/repair specialist should ensure:

a. Both main and guard receiver-transmitters are correctly programmed and configured, including loading of COMSEC keys.

b. The installed antennas match the frequency bands of the main and guard receiver-transmitters.

c. Operator and control panel switches on the base station and the mode control switch on both receiver-transmitters are correctly set for the desired mode of operation.

Table 6-3. Base Station Fault Messages

Fault Message	Fault Description
PA OVER TEMP	Power amplifier temperature is greater than 100°C. Power amplifier keyline is automatically disabled.
PA HIGH TEMP	Power amplifier temperature is greater than 90°C but less than 100°C. RF transmit power is reduced by one power level.
EPROM FAILED	System EPROM memory failure.
RAM FAILED	System RAM memory failure.
STACK OVFL	System RAM memory stack overflow occurred during operation.
RAD SER BUS	Receiver-transmitter serial communications bus error.
LOW RF POWER	RF transmit power is 6 dB or more below rated output.
NO GUARD RAD	Receiver-transmitter is malfunctioning or is not installed properly in the guard sleeve of the base station.
NO MAIN RAD	Receiver-transmitter is malfunctioning or is not installed properly in the main sleeve of the base station.
NO FAULTS	No fault.

Table 6-4. Organizational Maintenance Guide - Operator

Symptom	Possible Cause	Remedy
Base station does not have any lamps illuminated	Failed power cable	Replace power cable
	Failed power supply	Replace power supply
	Failed base station unit	Return the base station unit to the repair specialist for repair
No audio on both main and guard channels	Failed base station unit	Return the base station unit to the repair specialist for repair
No audio on main channel	Failed main receiver-transmitter	Replace main receiver-transmitter
	Failed base station unit	Return the base station unit to the repair specialist for repair
No audio on guard channel	Failed guard receiver-transmitter	Replace guard receiver-transmitter
	Failed base station unit	Return the base station unit to the repair specialist for repair
No or low RF power	Failed main receiver-transmitter	Replace main receiver-transmitter
	Failed power cable or power supply cable	Replace power cable and power supply cable
	Failed power supply	Replace power supply
	Failed base station unit	Return the base station unit to the repair specialist for repair
Keypad not working and/ or some displays do not illuminate	Faulty base station unit	Replace the base station unit
One or more specific bands will not operate	Failed main receiver-transmitter	Replace main receiver-transmitter
	Failed base station unit	Return the base station unit to the repair specialist for repair
Unit does not receive and transmit on the main channel or the range is severely reduced	Failed main receiver-transmitter	Replace main receiver-transmitter
	Failed main antenna cable	Replace main antenna cable
	Failed main antenna	Replace main antenna
	Failed power cable or power supply cable	Replace power cable
	Failed power supply	Replace power supply
	Failed base station	Return the base station unit to the repair specialist for repair

Table 6-4. Organizational Maintenance Guide - Operator - CONT

Symptom	Possible Cause	Remedy
Unit does not receive and transmit on the guard channel or the range is severely reduced	Failed guard receiver-transmitter	Replace guard receiver-transmitter
	Failed guard antenna cable	Replace guard antenna cable
	Failed guard antenna	Replace guard antenna
	Failed power cable or power supply cable	Replace power cable
	Failed power supply	Replace power supply
	Failed base station unit	Return the base station unit to the repair specialist for repair
Unit receives but will not transmit, and no transmit indicators are present	Failed audio accessory	Replace audio accessory
	Failed main receiver-transmitter	Replace main receiver-transmitter
	Failed base station unit	Return the base station unit to the repair specialist for repair
Unit receives and transmits, but with no modulation. All transmit indicators are present.	Failed audio accessory	Replace audio accessory
	Failed main receiver-transmitter	Replace main receiver-transmitter
	Failed base station unit	Replace base station unit
Base station does not have any lamps illuminated and does not receive or transmit	Failed main power source	Replace main power input
No audio on both main and guard channels: a. for any audio accessory b. for internal loudspeaker c. for external loudspeaker d. for accessory connected to HEADSET connector	a. Failed base station unit b. Failed internal loudspeaker c. Failed external loudspeaker d. Failed audio accessory c and d. If not corrected by remedy c or d, failed base station unit	a. Return base station unit to repair specialist b. Return base station unit to repair specialist c. Replace external speaker d. Replace audio accessory c and d. return base station unit to repair specialist
Unit does not receive and/or transmit encrypted traffic but does function in clear mode: a. main b. guard	a. Failed main receiver-transmitter b. Failed guard receiver-transmitter	a. Replace main receiver-transmitter b. Replace guard receiver-transmitter
Unable to power radio through side connector	Defective hand-held radio chassis	Return the hand-held radio chassis to the repair specialist for repair

Table 6-5. Organizational Maintenance Guide - Repair Specialist

Symptom	Possible Cause	Remedy
Base station does not have any lamps illuminated	Failed control interface CCA	Replace control interface CCA
	Failure elsewhere within base station assembly	Return the base station unit to the depot for repair
No audio on main or guard channels	Failed audio interface CCA	Replace audio interface CCA
	Failed control interface CCA	Replace control interface CCA
	Failed control panel assembly	Replace control panel assembly
	Failure elsewhere within base station assembly	Return the base station unit to the depot for repair
No audio on main channel	Failed audio interface CCA	Replace audio interface CCA
	Failed control interface CCA	Replace control interface CCA
	Failure elsewhere within base station assembly	Return the base station unit to the depot for repair
No audio on guard channel	Failed audio interface CCA	Replace audio interface CCA
	Failed control interface CCA	Replace control interface CCA
	Failure elsewhere within base station assembly	Return the base station unit to the depot for repair
No or low RF power	Failed control interface CCA	Replace control interface CCA
	Failed RF power amplifier	Replace RF power amplifier
	Failure elsewhere within base station assembly	Return the base station unit to the depot for repair
Keypad not working and/or some displays do not illuminate	Failed control interface CCA	Replace control interface CCA
	Failure elsewhere within base station assembly	Return the base station unit to the depot for repair
One or more specific bands will not operate (main and/or guard)	Failed receiver-transmitter (main or guard)	Replace receiver-transmitter (main or guard)
	Failed control interface CCA	Replace control interface CCA
	Failure elsewhere within base station assembly	Return the base station unit to the depot for repair

Table 6-5. Organizational Maintenance Guide - Repair Specialist - CONT

Symptom	Possible Cause	Remedy
Unit does not receive and transmit on the main channel or the range is severely reduced	Failed control interface CCA	Replace control interface CCA
	Failure elsewhere within base station assembly	Return the base station unit to the depot for repair
Unit does not receive and transmit on the guard channel or the range is severely reduced	Failed control interface CCA	Replace control interface CCA
	Failure elsewhere within base station assembly	Return the base station unit to the depot for repair
Unit receives but will not Transmit, and no transmit indicators are present	Failed audio interface CCA	Replace audio interface CCA
	Failure elsewhere within base station assembly	Return the base station unit to the depot for repair
Unit receives and transmits, But transmits with no modulation. All transmit indicators are present.	Failed audio interface CCA	Replace audio interface CCA
	Failure elsewhere within base station assembly	Return the base station unit to the depot for repair
Unit does not receive and/or transmit encrypted traffic but does function in clear mode: a. main b. guard	a. Failed system module in main receiver-transmitter b. Failed system module in guard receiver-transmitter	a. Replace system module in main receiver-transmitter b. Replace system module in guard receiver-transmitter
One or both speaker(s) are inoperative	Failed audio accessory, if applicable	Replace audio accessory
	Failed audio interface CCA	Replace audio interface CCA
	Failed control interface CCA	Replace control interface CCA
	Failed base station unit	Replace base station unit
Unable to power radio through side connector	Defective hand-held radio chassis	Return the hand-held radio chassis to the repair specialist for repair

Table 6-6. Cross-Reference to Removal/Replacement Procedures

Items to be Removed/Replaced	Applicable Procedure (Paragraph Number)
Antenna	6-5.1.1
Antenna cable	6-5.1.2
Audio interface CCA (A3)	6-5.2.2
Control interface CCA (A2)	6-5.2.1
Power amplifier (A6)	6-5.2.3
Power cable	6-5.1.4
Power supply	6-5.1.5
Receiver-transmitter	6-5.1.3

6-5 REMOVAL/REPLACEMENT PROCEDURES.

6-5.1 Removal/Replacement Procedures - Operator.

Prior to removing or installing any assembly, power down the equipment. Then remove all accessories (handset, headset, antenna, etc.) and disconnect the power supply cable. Removal/replacement procedures that are authorized to be performed by the operator are given in paragraphs 6-5.1.1 through 6-5.1.5.

6-5.1.1 Antenna Removal/Replacement.

Remove/replace the base station antenna(s) as follows:

a. Disconnect the antenna cable(s) (W3 and/or W4) from the connector mounted on the mast of the antenna to be removed/replaced.

NOTE

The antenna mast will need to be lowered to gain access to the antenna and antenna cable connector.

b. Remove the attached mounting hardware and remove the antenna from the mast.

c. Replace the antenna with a known good antenna and replace mounting hardware.

d. Reconnect the antenna cable.

6-5.1.2 Antenna Cable Removal/Replacement.

Remove/replace the antenna cable as follows:

a. Disconnect the antenna cable from the MAIN antenna connector (J5) or GUARD antenna connector (J3), as applicable, and from the antenna. Refer to Figures 2-2 and 4-4. The mast will need to be taken down to gain access to the antenna and the antenna cable connector.

b. Reconnect the antenna cable and re-erect the mast.

6-5.1.3 Receiver-Transmitter Removal/Replacement.

Remove/replace the receiver-transmitter as follows:

a. Remove the appropriate receiver-transmitter from the base station by turning the locking knob on the front panel counterclockwise one-quarter turn and pulling the receiver-transmitter from the sleeve. The main receiver-transmitter is located on the right of the base station front panel as viewed by the operator. The guard receiver-transmitter is located on the left.

b. Re-insert a known good receiver-transmitter into the base station and lock by turning the locking knob clockwise.

6-5.1.4 Power Cable Removal/Replacement.

Remove/replace the power cable as follows:

a. Disconnect the power cable from the POWER connector (J2) on the side of the base station by grasping the base of the power cable and turning counterclockwise one-quarter turn. (Refer to Figures 2-2 and 4-4.)

b. Replace a new power cable onto the POWER connector at the side of the base station.

6-5.1.5 Power Supply Removal/Replacement.

Remove/replace the base station power supply as follows:

a. Disconnect the power supply from the power source. Disconnect the two power cables and configuration plug from the power supply by grasping the connector of each power cable and turning counterclockwise one-quarter turn. Remove the power supply.

b. Replace the failed power supply with a known good power supply. Reconnect the two power cables and configuration plug to the power supply.

CAUTION

ELECTROSTATIC DISCHARGE

The base station contains CCAs and components that are susceptible to damage by electrostatic discharge (ESD). Disassembly of the base station should only be done at a properly grounded work station. Use ESD precautionary procedures (wear grounding wrist straps) when touching, removing, and installing the modules.

WARNING

Before performing removal/replacement procedures, make sure power is removed from the unit. Failure to do so could result in personal injury or damage to the equipment.

CAUTION

Use care in removing and replacing CCAs to prevent damage to pins and sockets.

6-5.2 Removal/Replacement Procedures - Repair Specialist.

The following procedures are authorized to be performed by the repair specialist only and are not applicable to the operator. Prior to performing any remove/replace procedures, ensure that the equipment is powered down and disconnected from the power source.

6-5.2.1 Control Interface CCA (A2) (SS-4100808-501) Removal/Replacement.

Remove/replace the control interface CCA (A2) as follows:

a. Remove the cover (41, Figure 7-2) from the bottom of the base station unit by removing the 17 captive screws (42) that secure the cover to the chassis.

b. Unplug the control interface CCA (44) by pulling evenly on the CCA extractors at each end of the CCA.

c. Reinsert a known good control interface CCA by pushing evenly on the CCA extractors at each end of the CCA. Ensure that the CCA edges are aligned with the tracks on the sides of the chassis.

d. Reattach the bottom cover by tightening the 17 captive screws that secure the bottom cover to the chassis. When refitting the bottom cover to the chassis, check EMI gasket (40) to ensure that it is undamaged and properly seated.

6-5.2.2 Audio Interface CCA (A3) (SS-4100809-501) Removal/Replacement.

Remove/replace the audio interface CCA (A3) as follows:

a. Remove the cover (41, Figure 7-2) from the bottom of the base station unit by loosening the 17 captive screws (42) that secure the cover to the chassis.

b. Lift up the audio interface CCA one or two inches by pulling evenly on the card extractors in order to provide unhindered access to connectors J1 and J2.

c. Disconnect the speaker cable assembly, W11(1), and the resistor cable assembly, W12, from the audio interface CCA (33) by lifting the outside tabs on each connector while pulling the connector body. Do not remove the connectors by pulling on wires.

d. Remove the audio interface CCA completely by pulling evenly on the card extractors.

e. Reinsert a known good audio interface CCA by pushing evenly on the CCA extractors at each end of the CCA. Ensure that the CCA edges are aligned with the tracks on the sides of the chassis.

f. Reconnect W11 and W12.

g. Reattach the bottom cover by tightening the 17 captive screws that secure the bottom cover to the chassis. When refitting the bottom cover to the chassis, check EMI gasket (40) to ensure that it is undamaged and properly seated.

6-5.2.3 Power Amplifier Assembly (A6) (SS-4100852-501) Removal/Replacement.

Remove/replace the power amplifier assembly (A6) as follows:

a. Turn the unit upside down and remove the bottom cover. Disconnect the amplifier control cable assembly (A6W1) from J4 on the parent board.

b. The power amplifier (PA) assembly (19, Figure 7-2) is located on top of the base station unit. First loosen the 20 captive screws that hold the PA assembly to the unit. Grasp one of the heatsink fins and slightly raise the front end of the assembly.

c. While holding the coaxial cable in place, unscrew the cable connector holding the coaxial RF cable assembly (W3)(32, Figure 7-2) to the RF Out (J4) connection on the assembly and pull cable W3 from the connection.

d. Desolder the power cable assembly (W4)(6) from the DC In (FL1) and GND connections on the PA assembly.

e. Remove the screws (9) holding the two cable clamps (7) onto the PA assembly and remove the cable holders and cables W3 and W4.

f. Unscrew the cable connector holding the coaxial RF cable assembly (W1)(17) to the RF IN/OUT (J2) connection on the PA assembly and pull cable W1 from the connection.

g. Unscrew the cable connector holding the coaxial RF cable assembly (W2)(18) to the RCV RF (J3) connection on the PA assembly and pull cable W2 from the connection.

h. Lift the PA assembly from the base station unit.

i. To replace, reverse the above steps.

CHAPTER 7 ILLUSTRATED PARTS BREAKDOWN

SECTION I. INTRODUCTION

7-1 GENERAL.

The Illustrated Parts Breakdown (IPB) lists, illustrates, and describes the parts used in the Scope Shield Radio Set AN/GRC-238. The items are manufactured by Racal Communications, Inc., Rockville, Maryland.

7-2 MAINTENANCE PARTS LIST.

The Maintenance Parts List (MPL), (Section II), consists of the complete systems divided into main groups. The main groups are broken down into assemblies, subassemblies, and details. The next higher assembly (NHA) is indicated for each separately illustrated item. Each assembly and subassembly listed is followed immediately by its component parts. In general, the assemblies and parts installed at the time the end item was manufactured are listed and identified in the manual. When an assembly/part (including vendor items) different from the original was installed during manufacture of the later items, series, or blocks, all assemblies and parts are listed (and "Usable on" coded). However, when the original assembly or part does not have continued application, only the preferred assembly or part is listed. When an assembly/part installed during modification, and the original does not have continued application, only the preferred item is listed. Interchangeable and substitute assemblies and parts, subsequently authorized by the Government, are not listed in this manual. When a standard size part can be replaced with an oversize/undersize part, the latter parts, showing sizes, are also listed.

a. Figure and Index Number Column. This column lists the figure and index number of each part illustrated in the related figure. The index numbers are in numerical sequence and indicate order of disassembly except where the order does not apply. Index numbers identify each part number shown in the related figure. Assemblies which have detail parts indexed are not indexed unless; the assembly is illustrated completely assembled on the same illustration; or it is identified as an assembly by bracketing or circling of components. When a group of parts (bolt, washer, nut) is used at a specific location for attachment purposes, one index number assigned is sufficient. The index number appears on the same line as the first part composing the group.

b. Part Number Column. This column lists the contractor's part number (drawing number), including dash numbers, assigned to each part. Vendor part numbers are listed when parts are identical to the contractor used part. Those parts which have Government Standards numbers assigned have the Government Standards number listed. Parts altered or selected for special fit, tolerance, etc., from vendor, commercial, or Government Standards part number of the altered or selected part follow the part description in the Description column. Item(s) of supply part number(s) and Contractor and Government Entity (CAGE) that is stocked, stored, and issued by the Government as identified by the Government during the initial provisioning process shall be identified by an (*) sign preceding the part number one space to the left. Government Furnished Equipment (GFE) and Contractor Furnished Equipment (CFE), covered by separate manuals are listed and identified by a number sign (#) inserted flush right following the part number. Decalcomania, metal-cals, and vinyl film markings are considered as parts. The part number for each marking will be followed by a asterisk (*) symbol inserted flush right. Requisition the marking in accordance with the requirements of AFR 6-1.

c. CAGE Column. This column contains a five-digit code number following the part number denoting the procuring vendor. The source of vendor code numbers is the CAGE for Manufacturer Cataloging Handbook H4-1, H4-2, and H4-3. When a CAGE for the appropriate manufacturer or Government agency is not published in the current issues of the H4 handbook, the word "none" will appear in this column.

d. Description Column. This column contains the description of all items appearing on the MPL. The indentation headed "1" through "7" consists of the approved item name, as found in the Federal Item Identification Guide for Supply Catalog Handbook H6-1, or is in accordance with the contractor's drawing title. The description contains modifiers necessary to identify the particular item. Additional information following the item description may include the following: a list of alternate part numbers to give stock ordering information; exceptions to the Usable On Code for the item; and references to preceding and subsequent figures concerning assemblies and subassemblies. This data is considered an integral part of the item description assuring the correctness of repair maintenance procedures.

e. Attaching Parts. Items used to attach parts or assemblies to each other are listed immediately after the part. The attaching parts have the same indentation code as the parts attached. The code (AP) appears on the same line with and immediately following the attaching part item.

f. Units Per Assembly. This column contains the number of units required per assembly and/or subassembly. If more than one assembly is required, the total number of assemblies is listed. When an assembly or subassembly is listed more than once, the total number of units per assembly or subassembly appears the first time and REF for subsequent listings.

g. Usable on Code Column. This column shows the Usable On Codes for systems, assemblies, and parts indicating specific usability by part number. Usable on code explanations are located at the bottom of the applicable page. The codes A, B, C, etc., when shown within a group, relate the part back to the same coded part within the next higher assembly. When this column is left bank, an assembly or part is common to all part number variation of the next higher assembly.

h. Source, Maintenance, and Recoverability (SMR) Codes. This manual contains Joint Military Services Uniform SMR codes. Detailed coding criteria may be obtained from T.O. 00-25-195.

7-3 NUMERICAL INDEX.

The Numerical Index (Chapter 7, Section III) is compiled in accordance with the numerical part number filing system described in paragraph a.

a. Part Number Column. This column contains all the part numbers that appear in the Maintenance Parts List and part numbers that have been assigned to detail parts assembled into the end article. The order of procedure establishing the precedence in which the part numbers are listed is explained below. The order of precedence in the first position of each part number is Letters A through Z, Numerals 0 through 9.

NOTE

Alphabetical O's are considered as numerical zeroes in all positions in each part number.

The order of precedence in the second and succeeding positions in each part number is as follows:

(1) Space (blank column).
(2) Diagonal (/).
(3) Period (.).
(4) Dash (-).
(5) Letters A through Z.
(6) Numerals 0 through 9.

The following is a sample of part numbers arranged in alphabetical-numerical sequence used in the Numerical Index.

AN931-4-13	B2	16.W2
A2460	S/1	16W060
A317	1140	32P010.1
A32	121873	32P0101
B12	128	39A45

b. Figure and Index Number Column. For each part number, the figure or figure and index number refers to the MPL where the parts relationship is shown. When an assembly or part has not been assigned an index number, the figure and index number of the preceding part in the MPL is used with the letter "F" before the figure, such as F7-7. The letter "F" denotes "follows".

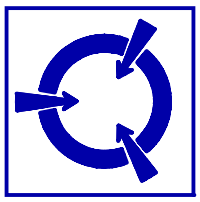
7-4 REFERENCE DESIGNATION INDEX.

The Reference Designation Index (Chapter 7, Section IV) is listed by figure as it appears in the MPL, then in alphabetical-numerical order, the reference designations used in schematic diagrams and instruction books. Opposite the reference designation is listed the figure index number as shown in the MPL.

7-5 ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES.

a. This technical order contains parts and assemblies sensitive to damage by ESD. T.O. 00-25-234 should be consulted for specific information on how damage can occur to electronic parts, assemblies, and equipment by ESD and the control measures to be taken to protect against such damage.

b. Illustrations contained within this manual which depict ESD parts are further identified by the use of the following symbol affixed in the lower right-hand corner of each applicable illustration.

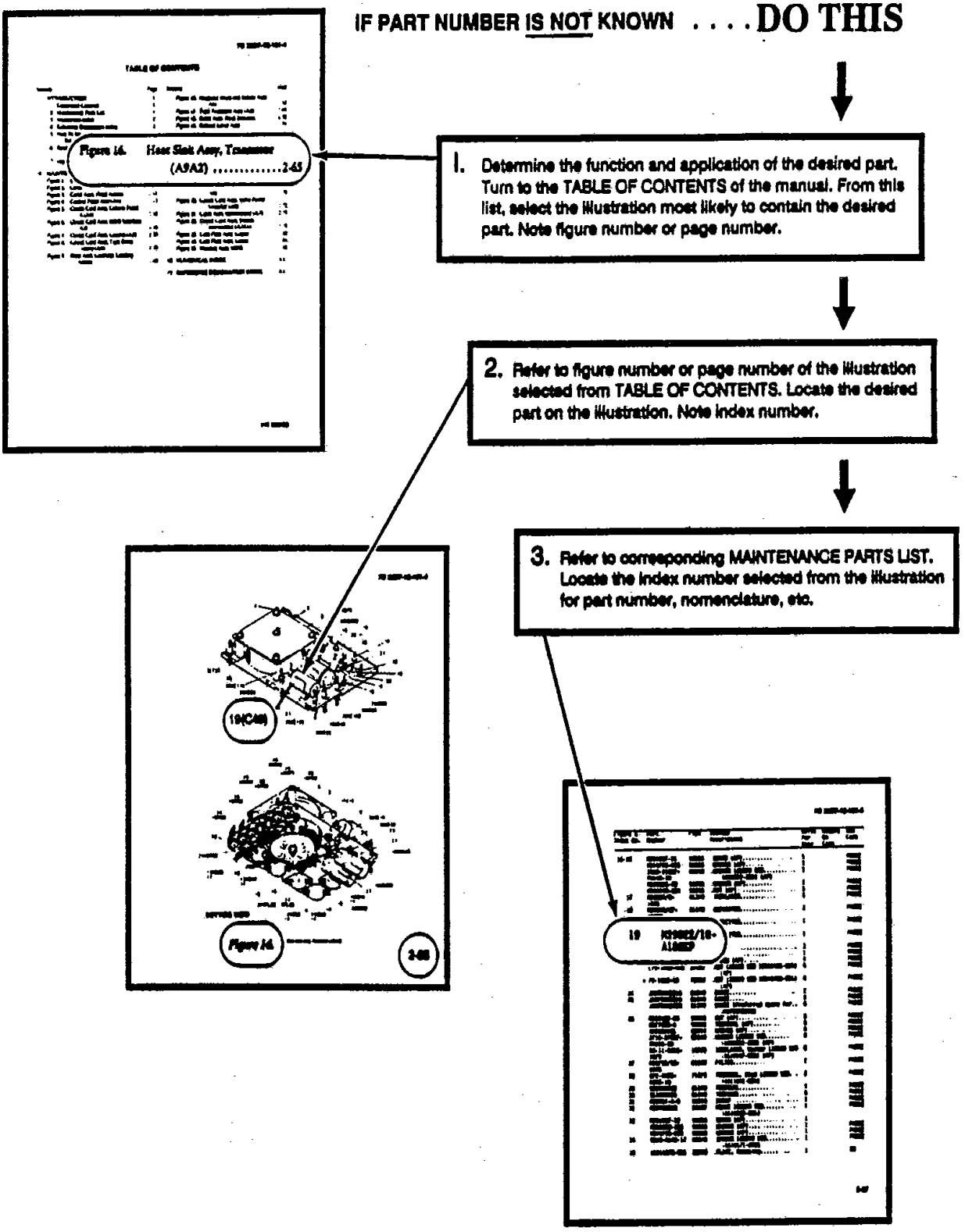


c. The MPL contained within this manual with ESD sensitive parts are identified by the following symbol (ESD). These symbols are placed in the extreme right of the description column for the item as ESD sensitive.

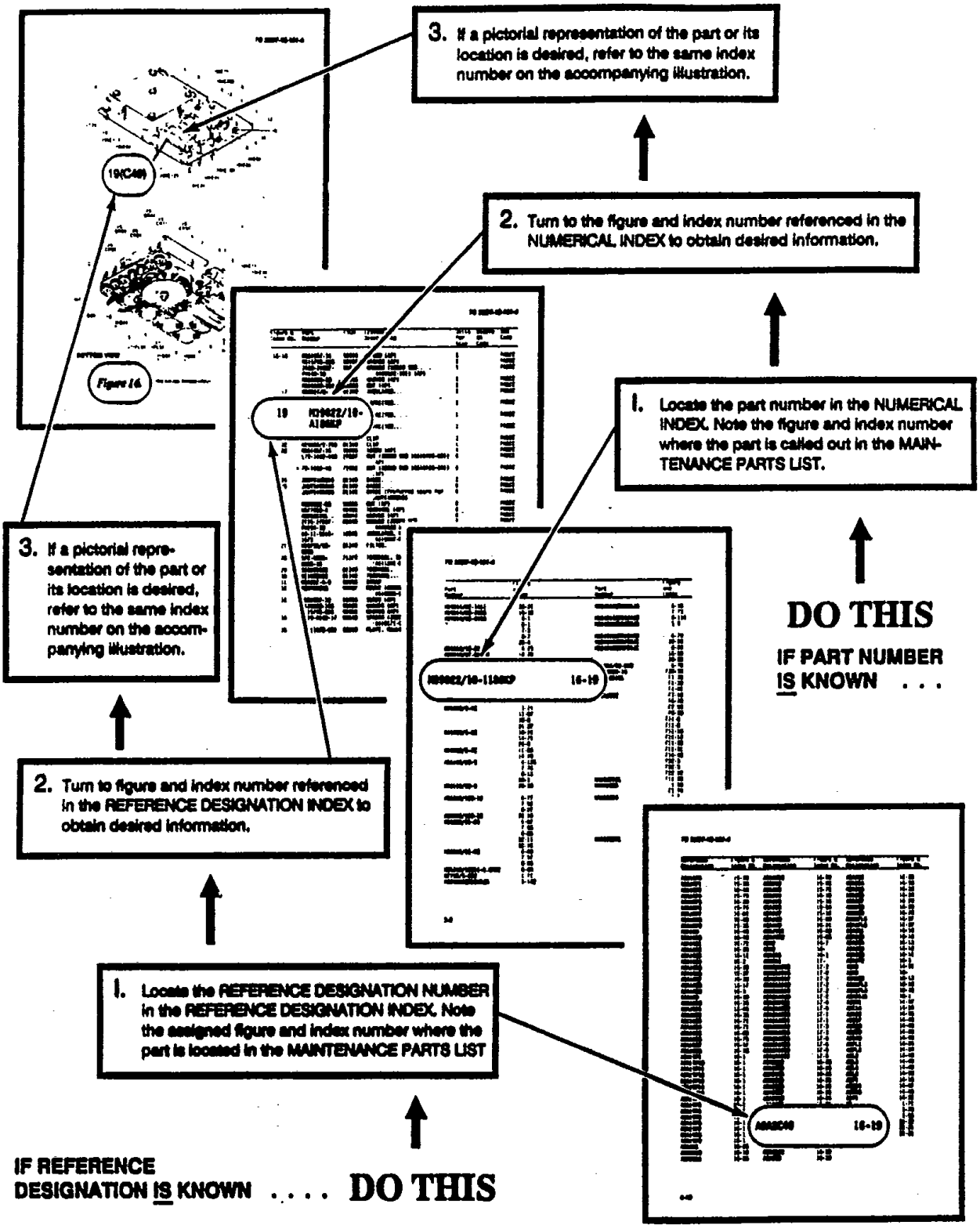
7-6 CAGE CODE SUMMARY.

CAGE	Manufacturer
00141	Precision Industrial Components Corp
04967	Fastener Specialty, Inc.
05972	Locktite Corp.
07700	Technical Wire Products, Inc.
0EV41	Catamount MFG, Inc.
0KJP9	Nextek, Inc.
14208	Minneapolis Speaker
18565	Chomerics, Inc.
1BZ19	C and S Antennas, Inc.
23386	Racal Communications, Inc.
23657	Shakespeare, Inc.
53217	Technical Wire Products, Inc.
53387	Minnesota Mining & MFG Co.
73734	Federal Screw Products, Inc.
79557	Vetex Computer Cable & Products
80205	National Aerospace
81349	Military Specifications
85480	Brady W. H. Co.
86928	Seastorm MFG Co., Inc.
96906	Military Standards

HOW TO USE THE ILLUSTRATED PARTS BREAKDOWN


IF PART NUMBER IS NOT KNOWN . . . . DO THIS
1. Determine the function and application of the desired part. Turn to the TABLE OF CONTENTS of the manual. From this list, select the illustration most likely to contain the desired part. Note figure number or page number.
2. Refer to figure number or page number of the illustration selected from TABLE OF CONTENTS. Locate the desired part on the illustration. Note index number.
3. Refer to corresponding MAINTENANCE PARTS LIST. Locate the index number selected from the illustration for part number, nomenclature, etc.

HOW TO USE THE ILLUSTRATED PARTS BREAKDOWN


3. If a pictorial representation of the part or its location is desired, refer to the same index number on the accompanying illustration.
2. Turn to the figure and index number referenced in the NUMERICAL INDEX to obtain desired information.
1. Locate the part number in the NUMERICAL INDEX. Note the figure and index number where the part is called out in the MAINTENANCE PARTS LIST.
DO THIS
IF PART NUMBER IS KNOWN . . .
3. If a pictorial representation of the part or its location is desired, refer to the same index number on the accompanying illustration.
2. Turn to figure and index number referenced in the REFERENCE DESIGNATION INDEX to obtain desired information.
1. Locate the REFERENCE DESIGNATION NUMBER in the REFERENCE DESIGNATION INDEX. Note the assigned figure and index number where the part is located in the MAINTENANCE PARTS LIST
IF REFERENCE DESIGNATION IS KNOWN . . . . DO THIS

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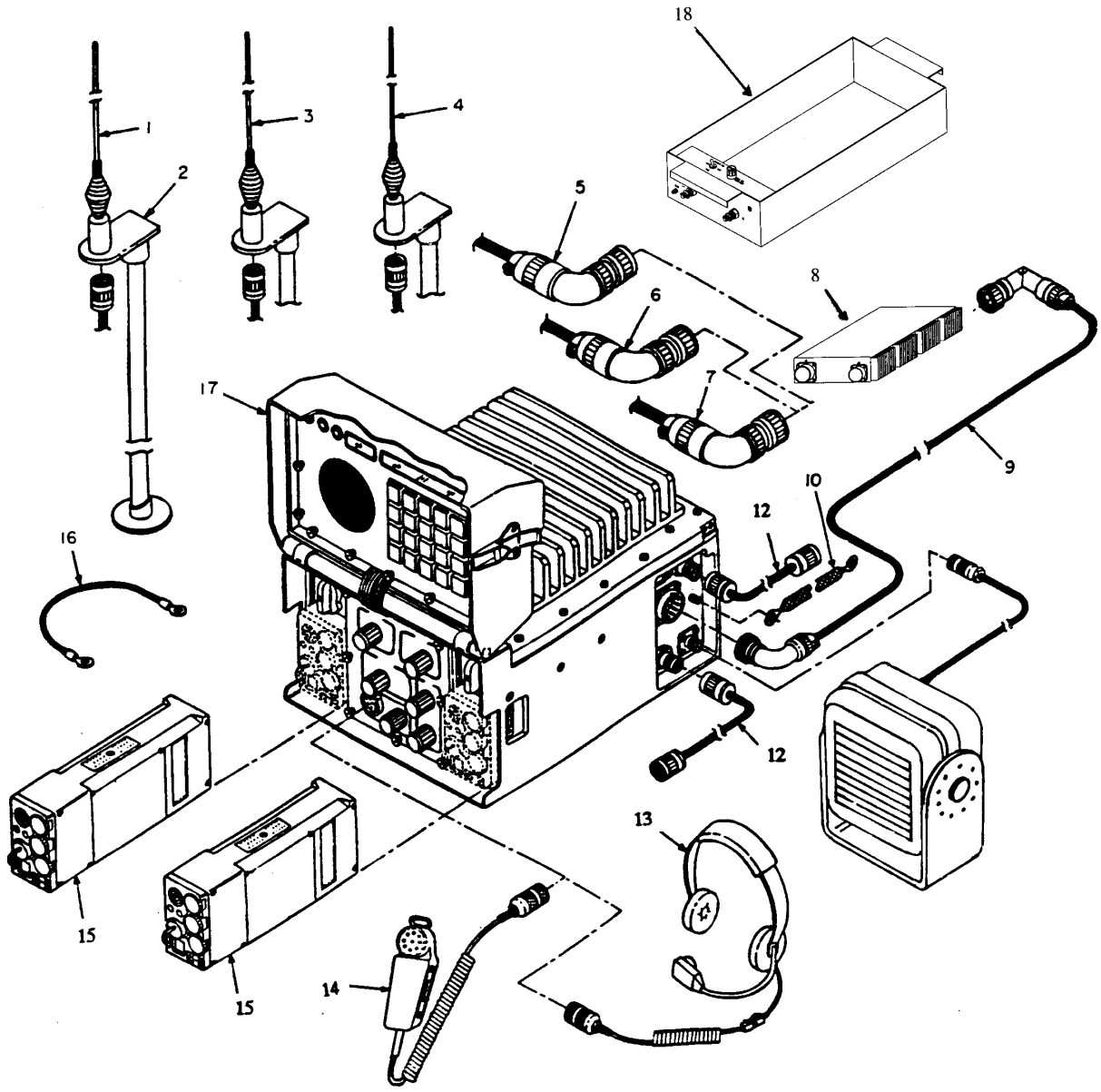

Figure 7-1. Radio Set AN/GRC-238

Section II. MAINTENANCE PARTS LISTS

Table 7-1. Radio Set AN/GRC-238

Figure & Index No.	Part Number	CAGE	Description 1 2 3 4 5 6 7	Units per Assy	Usable on Code	SMR Code
7-1	SS-4100792-502	23386	Radio Set AN/GRC-238	0001		PEODDS
7-1-1	4242-MK2-RAC	23657	• Antenna,30-88 MHz (23386/SS-1600230-1) (SPEC CTRL DRW)	0002		PAOZZN
7-1-2	SP30SS	1BZ19	• Mast Kit, Antenna, BS (23386/SS-1600280-1) (SPEC CTRL DRW)	0002		PAOZZN
7-1-2a	SL/33644	1BZ19	$ $ Antenna Adapter	0001		PAOZZN
7-1-2b	SL33641SH1	1BZ19	$ $ Top Guy Rope (Green)	0003		PAOZZN
7-1-2c	SL33641SH2	1BZ19	$ $ Middle Guy Rope (Black)	0003		PAOZZN
7-1-2d	AR31EF	1BZ19	$ $ Mast Section	0005		PAOZZN
7-1-2e	F209	1BZ19	$ $ Base Plate	0001		PAOZZN
7-1-2f	SL32223	1BZ19	$ $ Ground Anchor	0003		PAOZZN
7-1-2g	DG33640	1BZ19	$ $ Guy Plate	0001		PAOZZN
7-1-2h	Q86	1BZ19	$ $ Ground Spike	0002		PAOZZN
7-1-2j	SL33642-1	1BZ19	$ $ Transit Bag	0001		PAOZZN
7-1-3	4265-RAC	23657	• Antenna,136-174 MHz (23386/SS-1600230-2) (SPEC CTRL DRW)	0002		PAOZZN
7-1-4	4266-RAC	23657	• Antenna,403-470 MHz (23386/SS-1600230-3) (SPEC CTRL DRW)	0002		PAOZZN
7-1-5 (W1)	SS-4500104-501	23386	• Cable Assy, Power Supply	0001		PAOZZN
7-1-6 (W1)	SS-4500105-501	23386	• Cable Assy, Power Supply	0001		PAOZZN
7-1-7 (W1)	SS-4500106-501	23386	• Cable Assy, Power Supply	0001		PAOZZN
7-1-8	SS-1600282-501	23386	• Power Supply, BS (refer to T.O 31R2-2GRC238-3 for breakdown)	0001		PAOLDT
7-1-9 (W2)	SS-3500274-501	23386	• Cable Assy, BS Power	0001		PAOZZN
7-1-10 (W6)	SS-3500279-501	23386	• Strap Assy, Ground	0001		XB
7-1-11	Z3344	14208	• Loudspeaker, External (23386/SS-1600286-501) (SPEC CTRL DRW)	0001		PAOZZN
7-1-12 (W3,W4)	CPRG214-100-UHF/VHF	79557	• Cable, Antenna, Coaxial (23386/SS-1600290-1) (SPEC CTRL DRW)	0002		PAOZZN
7-1-13	HS-711 SS	28856	• Headset w/Boom Microphone (23386/SS-1600288-501) (SPEC CTRL DRW)	0001		PAOZZN
7-1-14	SS-3100520-501	23386	• Microphone, Dynamic	0001		PAOZZN
7-1-15	SS-4100807-502	23386	• RCVR-XMTR, Radio RT-1696/U (C) (refer to T.O 31R2-2PRC-139-3 for breakdown)	0002		PAODDT
7-1-16	SS-2400600-1	23386	• Plate, Identification	0001		XB

Figure & Index No.	Part Number	CAGE	Description 1 2 3 4 5 6 7	Units per Assy	Usable on Code	SMR Code
7-1-17	MS21318-20	96906	•‡Screw, Drive..... (23386/76986) (SPEC CTRL DRW)	0002		PAOZZN
7-1-18 (W7)	SS-2500116-501	23386	•‡Cable, Jumper.....	0001		PAOZZN
7-1-19	SS-4100804-501	23386	• Base Station Unit ..... (refer to Figure 7-2 for breakdown) (ESD)	0001		PAOLDT
7-1-20	SS-4100954-501	23386	• Primary Battery Tray	0001		PAOZZN
Not Illustrated (W5)	SS-3500276-501	23386	• Cable Assembly, Programming.....	0001		PAOZZN

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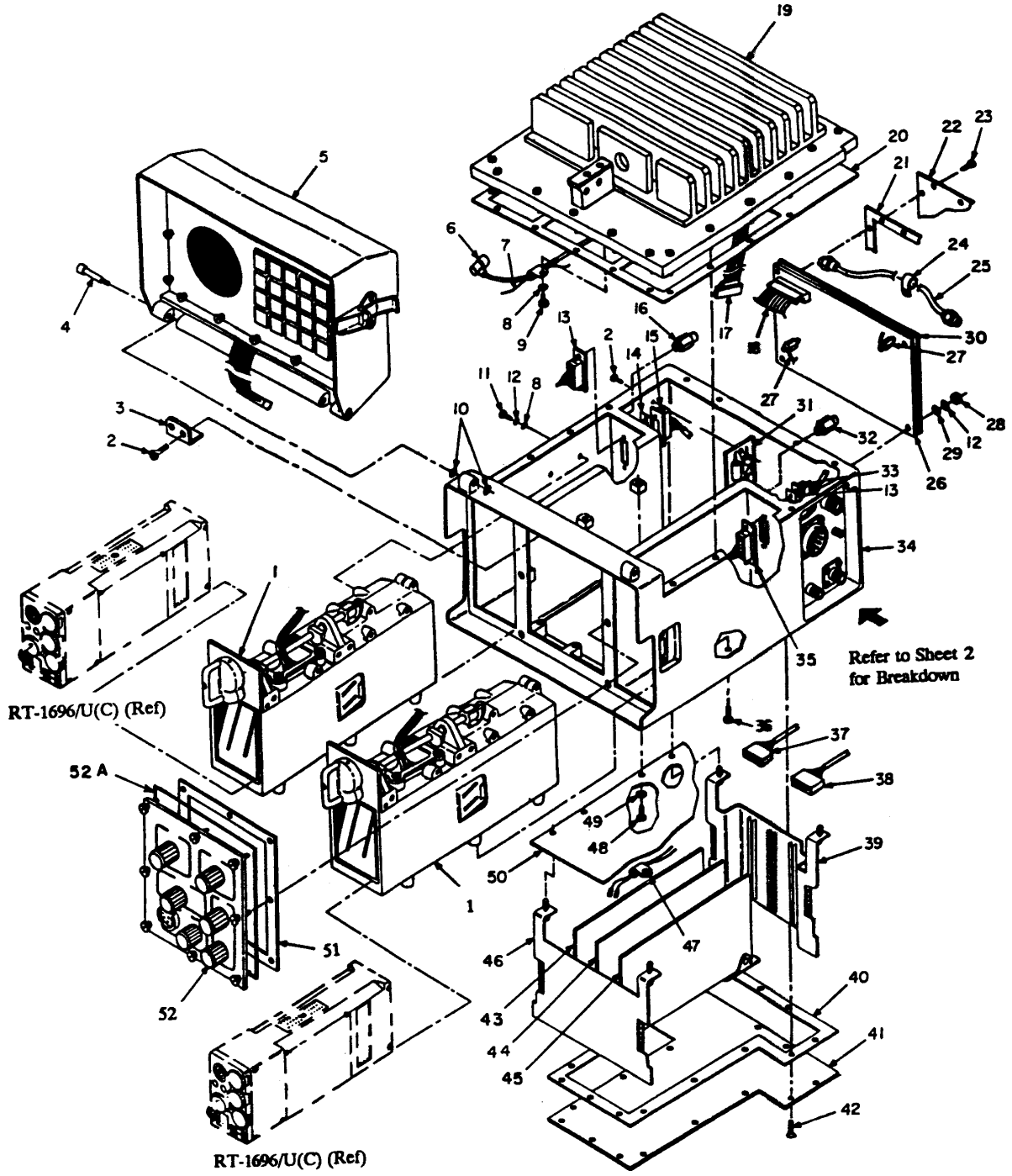

Figure 7-2. Base Station Assembly (SS-4100804-501) (Sheet 1 of 2)

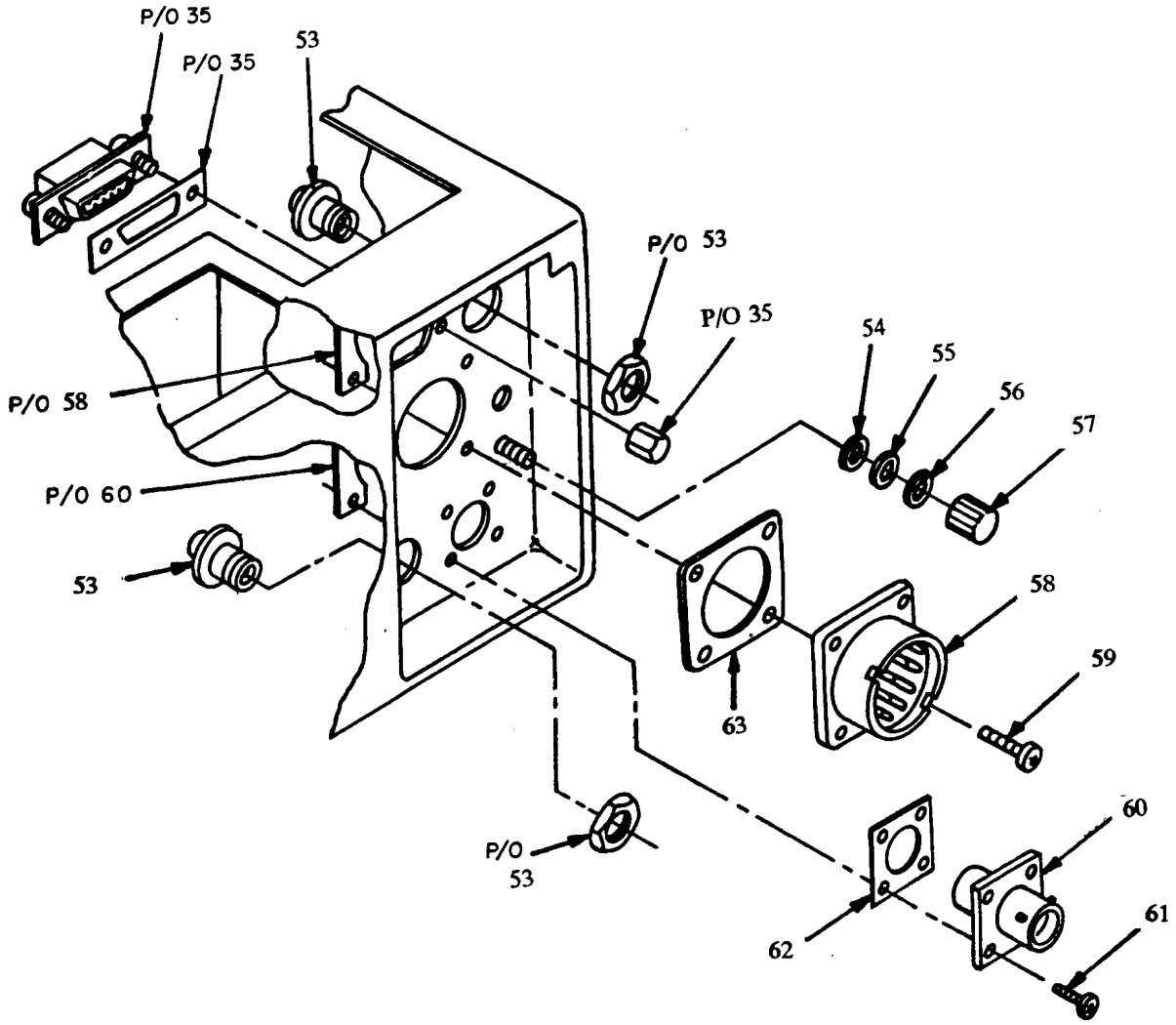

Figure 7-2. Base Station Assembly (SS-4100804-501) (Sheet 2 of 2)

Table 7-2 Base Station Assembly (SS-4100804-501)

Figure & Index No.	Part Number	CAGE	Description 1 2 3 4 5 6 7	Units per Assy	Usable on Code	SMR Code
7-2	SS-4100804-501	23386	Base Station Unit (ESD).....	0001		PAOLDT
7-2-1 (A8,A9)	SS-4100823-501	23386	@ Sleeve Assembly..... (refer to T.O 312R2-2GRC238-3 for breakdown)	0002		PADDDT
7-2-2	MS3212-12	96906	@ Screw, Machine ..... (23386/79144-632-05) (SPEC CTRL DRW)	0002		PADZZN
7-2-3	SS-2400545-1	23386	@ Plate, Retaining Cable	0001		XB
7-2-4	4324	00141	@ Screw, Shoulder..... (23386/SS-79207) (SPEC CTRL DRW)	0002		PADZZN
7-2-5 (A5)	SS-4100810-501	23386	@ Panel Assy, Control ..... (refer to T.O. 31R2-2GRC238-3 for breakdown) (ESD)	0001		PADDDT
7-2-6 (W4)	SS-2500094-501	23386	@ Cable Assy, PA Power.....	0001		PADZZN
7-2-7	F4NY-250BK	85480	@ Clamp, Cable..... (23386/81252) (SPEC CTRL DRW)	0002		PADZZN
7-2-8	MS15795-804	96906	@ Washer, Flat ..... (23386/75023) (SPEC CTRL DRW)	0020		PADZZN
7-2-9	MS51957-14	96906	@ Screw, Machine ..... (23386/77613) (SPEC CTRL DRW)	0002		PADZZN
7-2-10	SS-75170	23386	@ Washer, Flat ..... (23386/SS-75170) (SPEC CTRL DRW)	0004		PADZZN
7-2-11	77616	23386	@ Screw, Machine ..... (23386/77616) (SPEC CTRL DRW)	0006		PADZZN
7-2-12	MS35338-135	96906	@ Washer, Lock-Spring..... (23386/75002) (SPEC CTRL DRW)	0022		PADZZN
7-2-13 (W9)	SS-3500308-501	23386	@ Cable Assy, Ribbon	0001		PADZZN
7-2-14	82-01871	07700	@ Gasket, EMI 15 Pin D..... (23386/SS-70971) (SPEC CTRL DRW)	0002		PADZZN
7-2-15 (W12)	SS-3500287-502	23386	@ Cable Assy, Speaker	0001		PADZZN
7-2-16	SS-3600078-1	23386	@ Cable, RF SMA Soft Dorm	0001		PADZZN
7-2-17 (W1)	SS-2500091-501	23386	@ Cable Assy, Coaxial.....	0001		PADZZN
7-2-18 (W2)	SS-2500091-505	23386	@ Cable Assy, Coaxial.....	0001		PADZZN
7-2-19 (A6)	SS-4100852-501	23386	@ Power Amplifier Assembly ..... (refer to T.O. 31R2-2GRC238-3 for breakdown) (SPEC CTRL DRW) (ESD)	0001		PAODDT
7-2-20	SS-4400220-1	23386	@ Gasket, EMI	0001		PADZZN
7-2-21	39-21-A779-1294	18565	@ Gasket, EMI 9 Pin D..... (23386/SS-70970) (SPEC CTRL DRW)	0001		PADZZN

Figure & Index No.	Part Number	CAGE	Description 1 2 3 4 5 6 7	Units per Assy	Usable on Code	SMR Code
7-2-22	SS-4100902-501	23386	Cover Assembly, Rear	0001		XB
7-2-23	MS24693-C3	96906	Screw, Flathead (23386/77813) (SPEC CTRL DRW)	0015		PADZZN
7-2-24	F2NY-187BK	0EV41	Clamp, Cable NYL (23386/81251) (SPEC CTRL DRW)	0001		PADZZN
7-2-25 (W13)	SS-2500117-501	23386	Cable Assy, RF	0001		PADZZN
7-2-26 (A7)	SS-4100825-501	23386	Filter Assembly, Harmonic (refer to T.O 31R2-2GRC238-3 for breakdown) (SPEC CTRL DRW) (ESD)	0001		XB
7-2-27	M24308-25-9	81349	Screw Lock, Male (23386/610033) (SPEC CTRL DRW)	0004		PADZZN
7-2-28	NAS671C4	80205	Nut, Plain, Hexagon (23386/75203) (SPEC CTRL DRW)	0004		PADZZN
7-2-29	MS15795-803	96906	Washer, Flat (23386/75022) (SPEC CTRL DRW)	0004		PADZZN
7-2-30	SS-4400226-1	23386	Gasket, EMI	0001		PADZZN
7-2-31 (W14)	SS-2500095-501	23386	Cable Assy, Resistor	0001		PADZZN
7-2-32 (W3)	SS-2500093-501	23386	Cable Assy, RF	0001		PADZZN
7-2-33 (W11)	SS-3500286-502	23386	Cable Assy, RS232	0001		PADZZN
7-2-34	SS-4100768-501	23386	Chassis Assy, BS, Machined	0001		XB
7-2-35 (W10)	SS-3500294-501	23386	Cable Assy, RF	0001		PADZZN
7-2-36	M24308-26-1	81349	Screw, Lock Female (23386/SS-610207) (SPEC CTRL DRW)	0006		PADZZN
7-2-37 (W7)	SS-3500293-502	23386	Cable Assy, HHR Cont.	0001		PADZZN
7-2-38 (W8)	SS-3500293-501	23386	Cable Assy, HHR Control (23386/SS-610207) (SPEC CTRL DRW)	0001		PADZZN
7-2-39	SS-3100532-502	23386	Bracket Assembly, Retaining	0001		XB
7-2-40	SS-4400219-1	23386	Gasket, EMI	0001		PADZZN
7-2-41	SS-4100878-501	23386	Cover Assembly, Cover, Bottom	0001		XB
7-2-42	MS3212-13	96906	Screw, Machine (23386/79144-632-06) (SPEC CTRL DRW)	0016		PADZZN
7-2-43 (A1)	SS-4100771-501	23386	CCA, Reference Oscillator (refer to T.O 31R2-2GRC238-3 for breakdown) (ESD)	0001		PADDDT
7-2-44 (A2)	SS-4100808-501	23386	CCA, Interface, Control (refer to T.O 31R2-2GRC238-3 for breakdown) (ESD)	0001		PAOLDT
7-2-45 (A3)	SS-4100809-501	23386	CCA, Interface, Audio (refer to T.O 31R2-2GRC238-3 for breakdown) (ESD)	0001		PAOLDT

Figure & Index No.	Part Number	CAGE	Description 1 2 3 4 5 6 7	Units per Assy	Usable on Code	SMR Code
7-2-46	SS-3100531-502	23386	@ Bracket Assembly, Retaining	0001		XB
7-2-47	3484-1000	53387	@ Clamp, Cable (23386/81266) (SPEC CTRL DRW)	0001		PADZZN
7-2-48	MS51957-28	96906	@ Screw, Machine (23386/77628) (SPEC CTRL DRW)	0004		PADZZN
7-2-49	MS15795-806	96906	@ Washer, Flat (23386/75025) (SPEC CTRL DRW)	0004		PADZZN
7-2-50 (A4)	SS-4100811-501	23386	@ CCA, Parent Board	0001		PADZZN
7-2-51	SS-3400331-1	23386	@ Gasket, EMI	0001		PADZZN
7-2-52 (A12)	SS-4100879-501	23386	@ Panel Assy, Front, Operator (refer to T.O 31R2-2GRC238-3 for breakdown) (ESD)	0001		PAOLDT
7-2-52a	SS-4100866-501	23386	@@ CCA, Control Panel	0001		PADZZN
7-2-53	780-0009	0KJP9	@ Lightening Protector (23386/SS-3600073-1) (SPEC CTRL DRW)	0004		PADZZN
7-2-54	5710-54-25	86928	@ Washer, Flat (23386/75106) (SPEC CTRL DRW)	0001		PADZZN
7-2-55	MS15795-810	96906	@ Washer, Flat (23386/75029) (SPEC CTRL DRW)	0001		PADZZN
7-2-56	MS35338-139	96906	@ Washer, Lock-Spring (23386/75006) (SPEC CTRL DRW)	0001		PADZZN
7-2-57	8073-NP	73734	@ Nut, Thumb (23386/SS-754005) (SPEC CTRL DRW)	0001		PADZZN
7-2-58	FSU-2201	04967	@ Nut, Retainer (23386/SS-64022) (SPEC CTRL DRW)	0001		PADZZN
7-2-59	MS3212-4	96906	@ Screw, Machine (23386/SS-79144-440-07) (SPEC CTRL DRW)	0008		PADZZN
7-2-60	FSU-1001	04967	@ Nut, Retainer (23386/SS-64023) (SPEC CTRL DRW)	0001		PADZZN
7-2-61	MS51957-15	96906	@ Screw, Machine (23386/77614) (SPEC CTRL DRW)	0012		PADZZN
7-2-62	82-61461	53217	@ Plate, Retaining, Elec. (23386/SS-70973) (SPEC CTRL DRW)	0001		PADZZN
7-2-63	82-61652	07700	@ Shielding Gasket, Elec. (23386/SS-70972) (SPEC CTRL DRW)	0001		PADZZN

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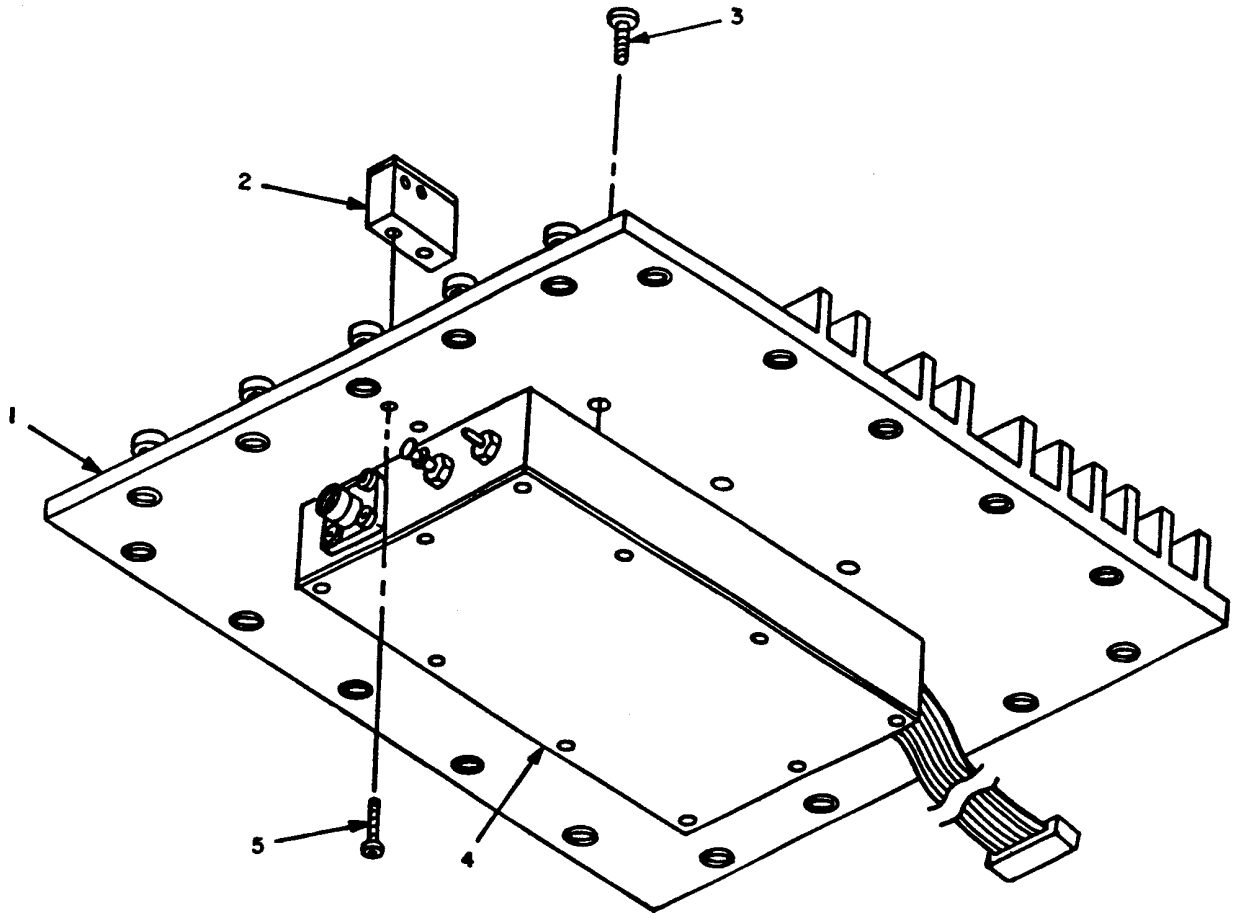

Figure 7-3. Power AMP Assy, 60W (SS-4100852-501)

Table 7-3. Power AMP Assy, 60W (SS-4100852-501)

Figure & Index No.	Part Number	CAGE	Description 1 2 3 4 5 6 7	Units per Assy	Usable on Code	SMR Code
7-3	SS-4100852-501	23386	Power AMP Assy, 60W..... (refer to T.O. 31R2-2GRC238-3 for breakdown) (ESD)	0001		PAODDT
7-3-1	SS-4100832-501	23386	▯ Heatsink,60W Power Amp	0001		XB
7-3-2	SS-3100542-501	23386	▯ Block Assembly, Detent	0001		XB
7-3-3	MS3212-15	96906	▯ Screw, Machine..... (23386/79144-632-08) (SPEC CTRL DRW)	0006		PADZZN
7-3-4	SS-4100856-501	23386	▯ Amplifier Assy, 60W ..... (refer to T.O. 31R2-2GRC238-3 for breakdown) (ESD)	0001		PAOLDT
7-3-5	MS3212-14	96906	▯ Screw, Machine..... (23386/79144-632-10) (SPEC CTRL DRW)	0002		PADZZN

Section III. NUMERICAL INDEX

Part Number	Figure & Item Number	Part Number	Figure & Item Number	Part Number	Figure & Item Number
3484-1000	7-2-47	F209	7-1-2e	MS3212-13	7-2-42
39-21-A779-1294	7-2-21	F2NY-187BK	7-2-24	MS3212-15	7-3-3
4242-MK2-RAC	7-1-1	F4NY-250BK	7-2-7	MS3212-17	7-3-5
4265-RAC	7-1-3	FSU-1001	7-2-60	MS3212-4	7-2-59
4266-RAC	7-1-4	FSU-2201	7-2-58	MS35338-135	7-2-12
4324	7-2-4	HS-711 SS	7-1-13	MS35338-139	7-2-56
5710-54-25	7-2-54	M24308-25-9	7-2-27	MS51957-14	7-2-9
780-0009	7-2-53	M24308-26-1	7-2-36	MS51957-15	7-2-61
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CHAPTER 8 CIRCUIT DIAGRAMS

8-1 SCOPE.

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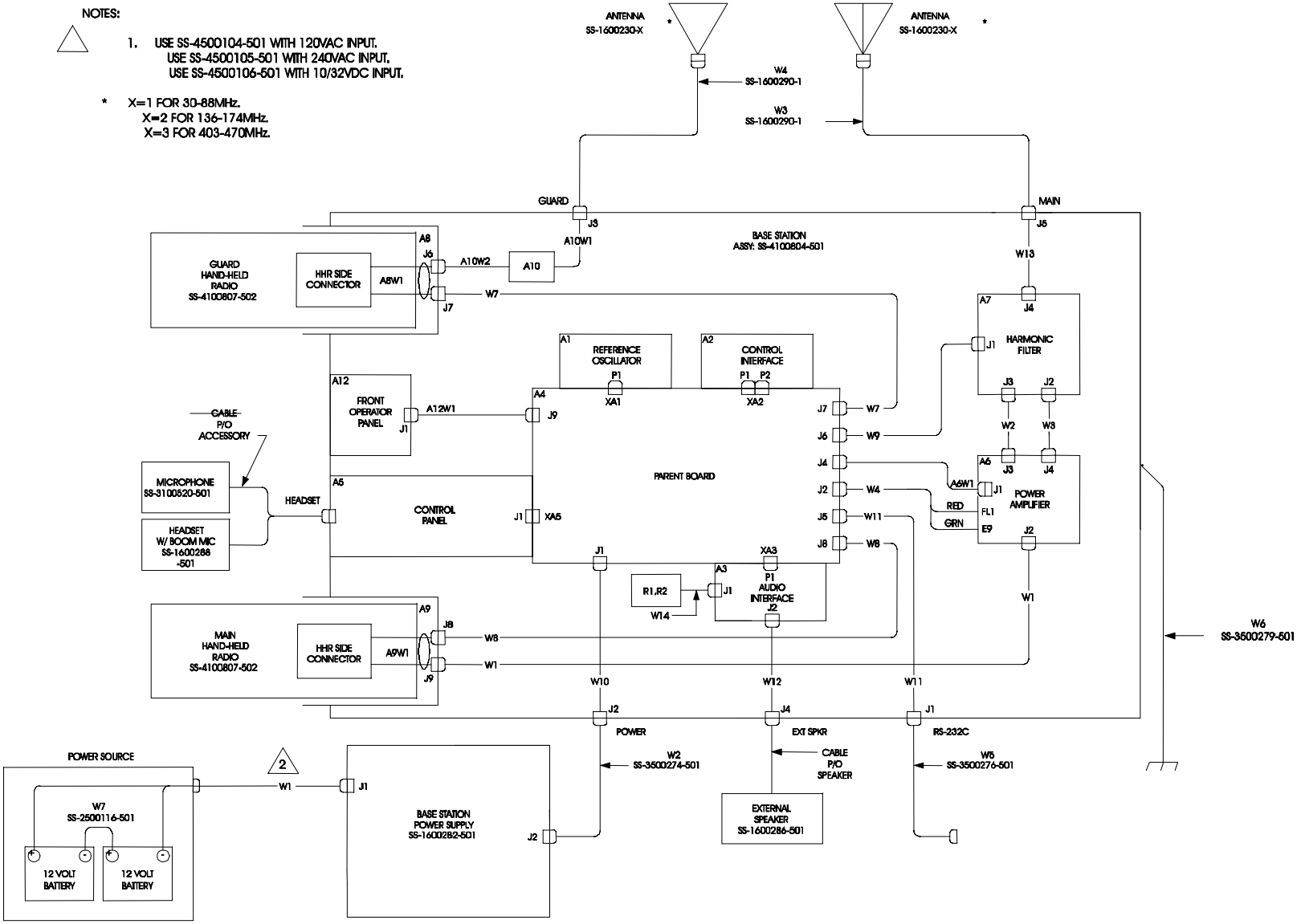
FO-2	Control Interface CCA, Block Diagram



FO-1. Radio Set AN/GRC-238, Interconnection Diagram

FO-2. Control Interface CCA, Block Diagram

GLOSSARY

AC	Alternating Current
A/D	Analog-to-Digital
ALC	Automatic Level Control
A/R	As Required
ASSY	Assembly
BCD	Binary Coded Decimal
BS	Base Station
C	Celsius (Centigrade)
CARC	Chemical Agent Resistant
CCA	Circuit Card Assembly
CCI	Controlled Cryptographic Item
CLR	Clear
CM	Centimeter
COMSEC	Communications Security
CTRL	Control
cu	Cubic
CW	Continuous Wave
dB	Decibels
dBi	Decibel (isotropic)
dBD	Decibels relative to a 1/2 wavelength dipole
dBm	Power in decibels (referenced to 1 milliwatt)
DC	Direct Current
DRW	Drawing
EMP	Electromagnetic Pulse
ENTR	Enter
ESD	Electrostatic Discharge
ESDS	Electrostatic Discharge Sensitive
EXT	External
F	Fahrenheit
FM	Frequency Modulation
FREQ	Frequency
G	Guard
G/RX	Guard Radio Receive
G/TX	Guard Radio Transmit
GND	Ground
HF	High Frequency
Hz	Hertz
IF	Intermediate Frequency
in.	Inch
INF	Infinite
INT	Internal
kbps	Kilobits/second
kg	Kilogram
kHz	Kilohertz
LED	Light Emitting Diode
M	Main
MHz	MegaHertz

M/RX	Main Radio Receive
M/TX	Main Radio Transmit
MOM	Momentary
MSG	Message
NBC	Nuclear, Chemical, and Biological
PC	Printed Circuit
PRGM	Program
PTT	Push-To-Talk
PWM	Pulse Width Modulation
RX	Receiver
SINAD	Signal + Noise + Distortion/Noise + Distortion
SPEC	Specification
SPKR	Speaker
TCXO	Temperature Compensated Crystal Oscillator
TX	Transmitter
TX/RX	Transmit/Receive
UHF	Ultra High Frequency
UUT	Unit Under Test
V	Volt
VAC	Volts, Alternating Current
VCO	Voltage Controlled Oscillator
VDC	Volts, Direct Current
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio
W	Watts
Z	Zeroize

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